

Sitthvað um vind og vindorku

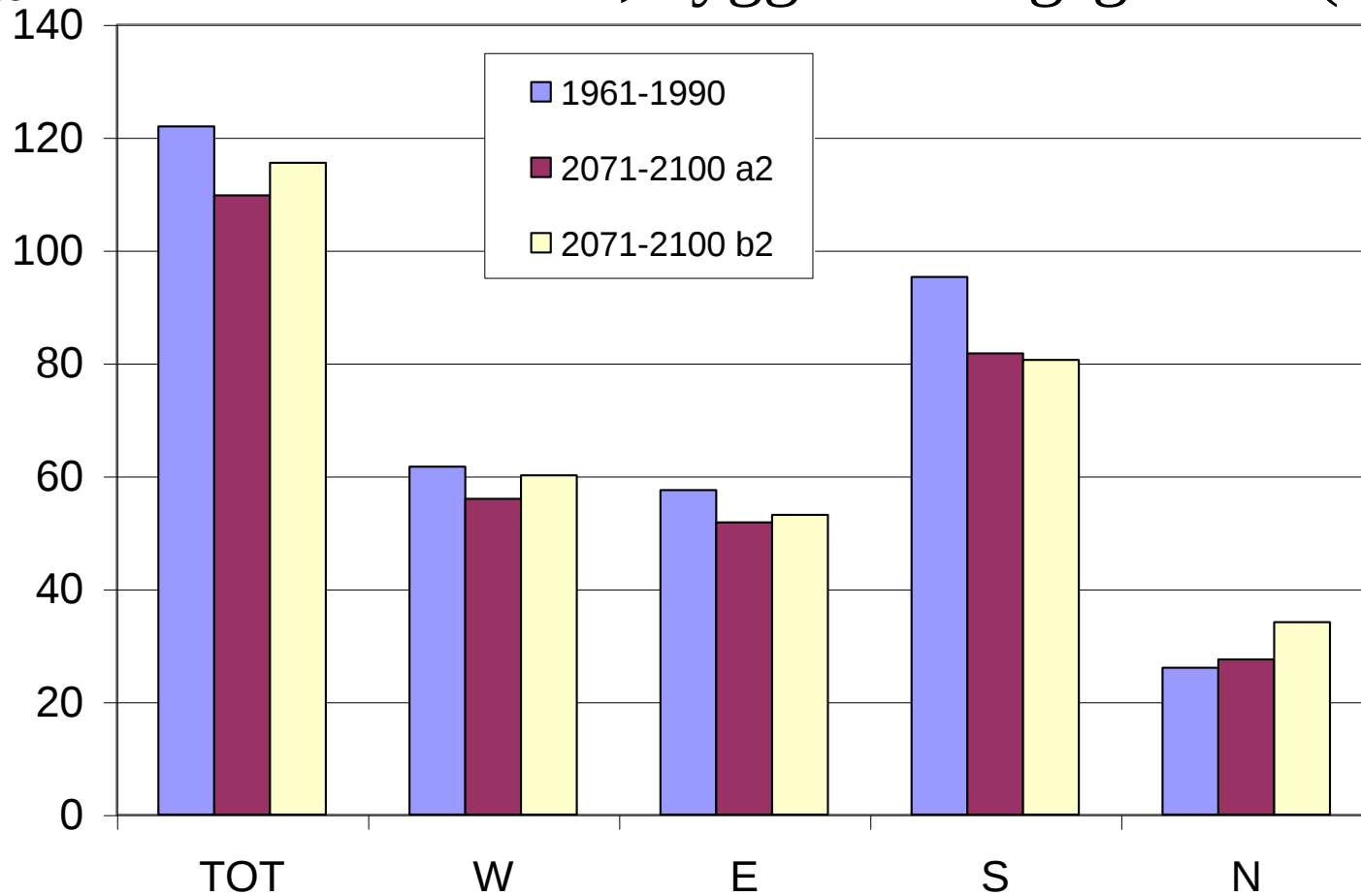
Haraldur Ólafsson

Ólafur Rögnvaldsson, Hálf dán Ágústsson

Sarah Poret

Framtíðarhorfur, byggðar á dagsgildum (HadAM)

Orkukflæði

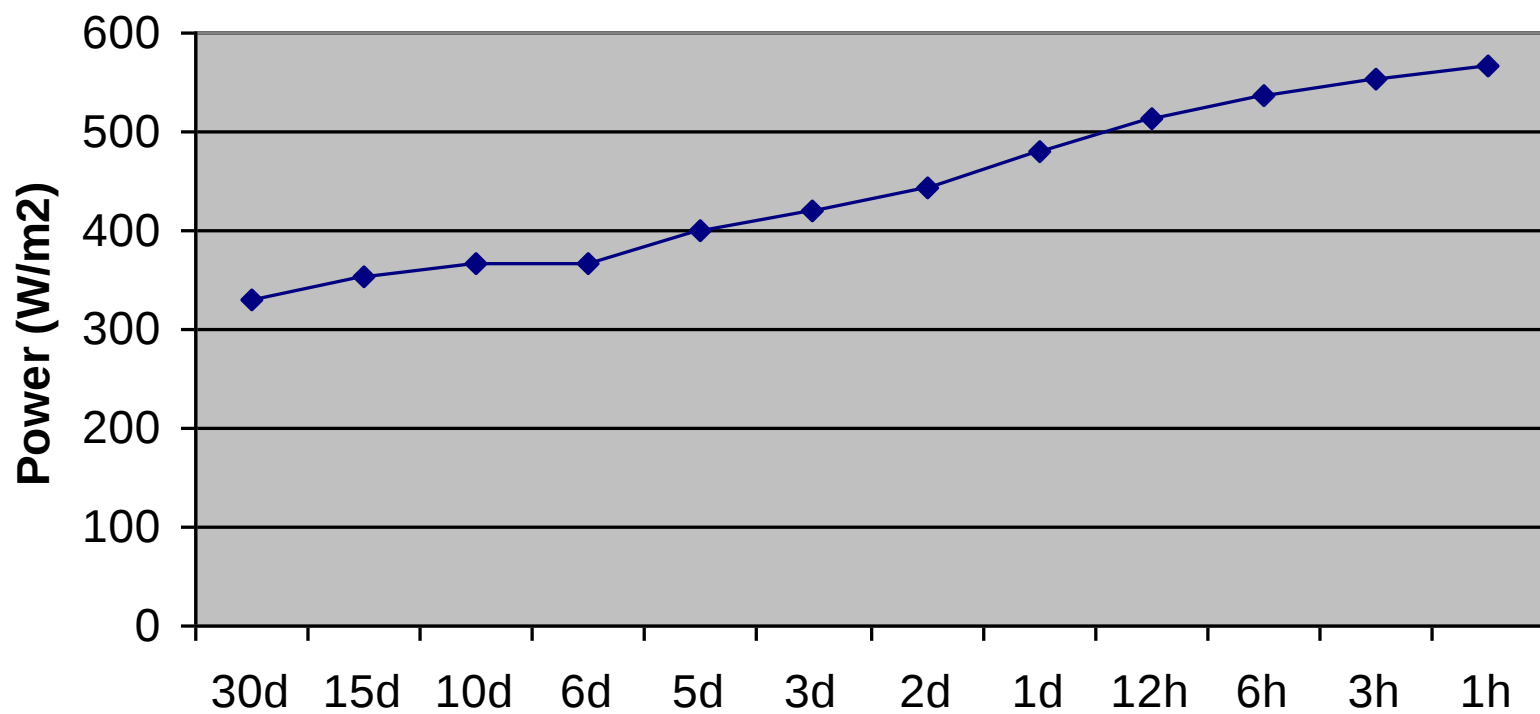


Sagan hefst í CE, CES, VVO VO

Vindátt

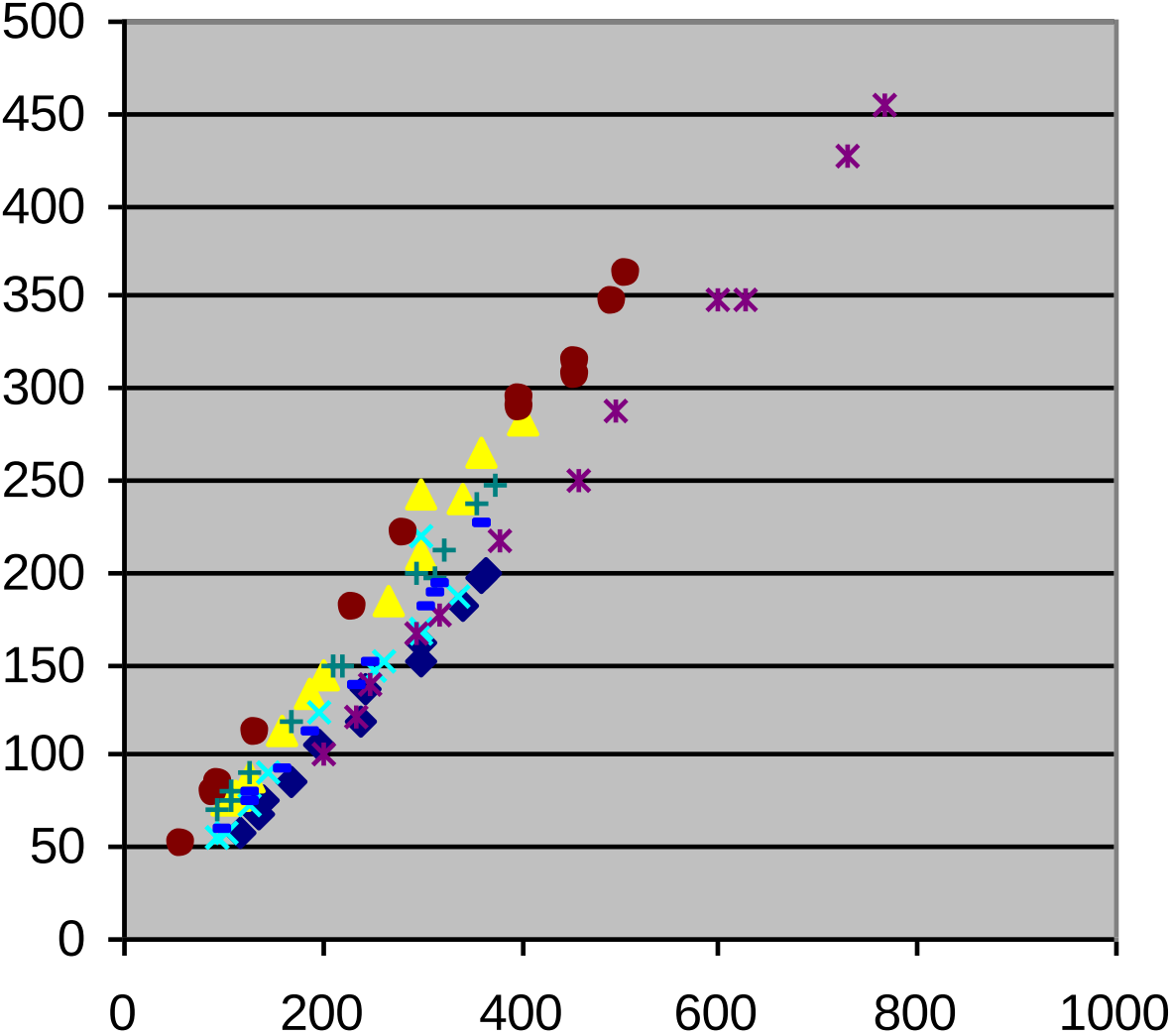
(Meðaltal vinds) í 3 veldi er ekki sama og
meðaltal (vinds í 3 veldi)

Garðskagaviti (January 1996-2005)



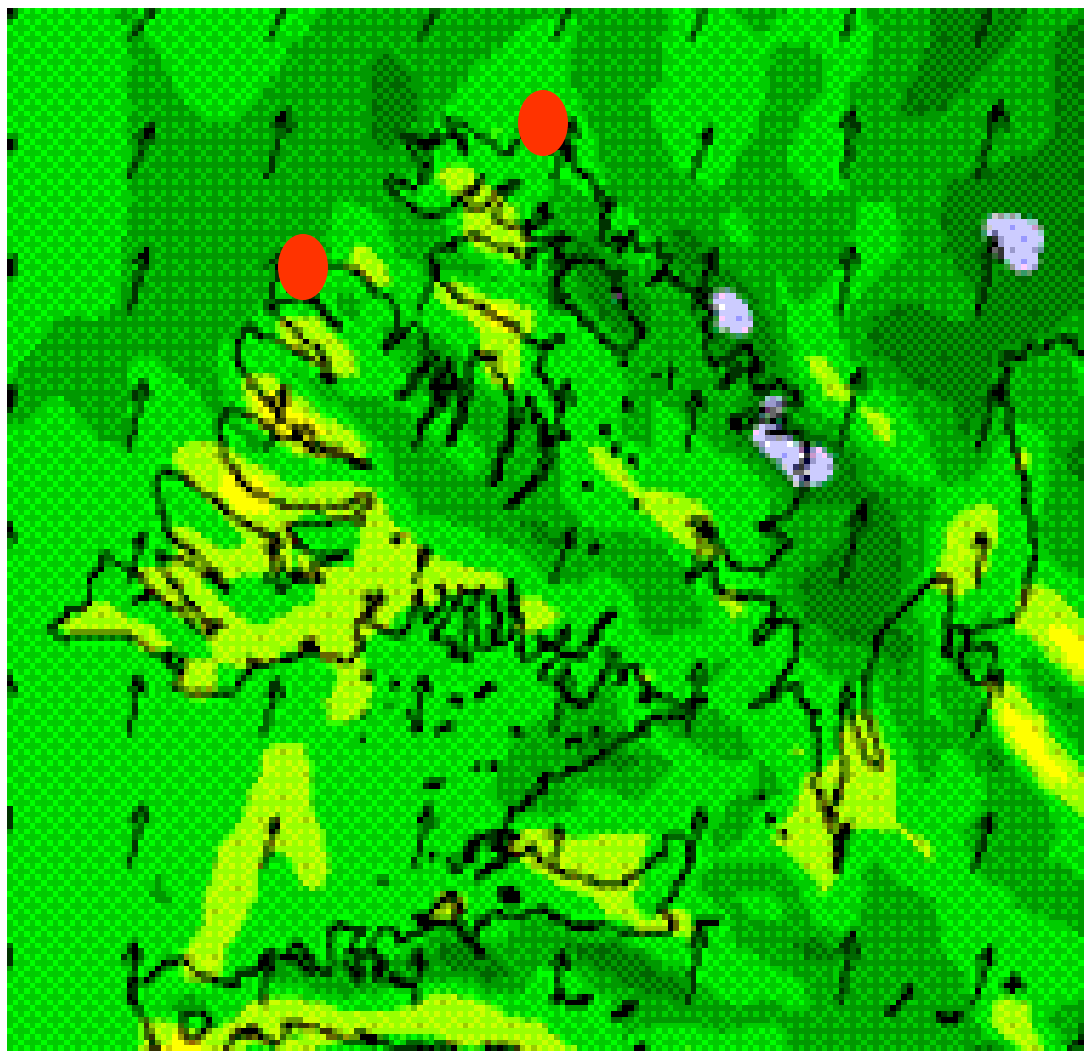
$Me\acute{d}al(U^3)-(Ume\acute{d}al)^3$

U3-Umean



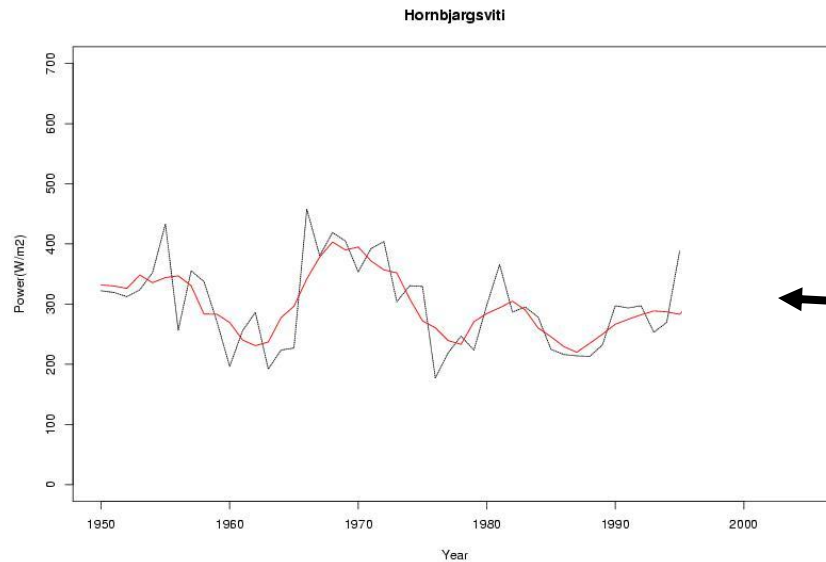
- ◆ Keflavik
- ▲ Dalatangi
- × Raufarhöfn
- × Hveravellir
- Hornbjargsviti
- + Galtarviti
- Stykkisholmur

Mestu munar á vindorkuflæði meðalvinds til langs tíma og
10 mín meðalvinds undir fjöllum

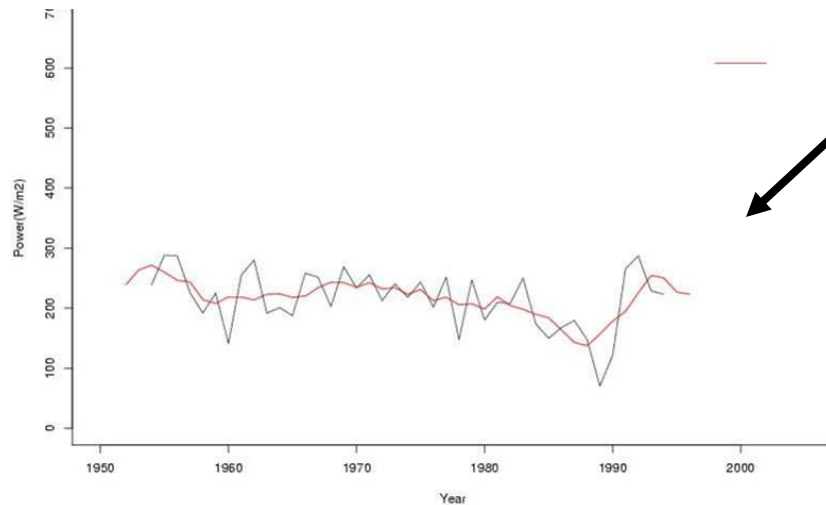


Langtímabreytileiki vindorkuflæðis á Galtarvita og Hornbjargsvita

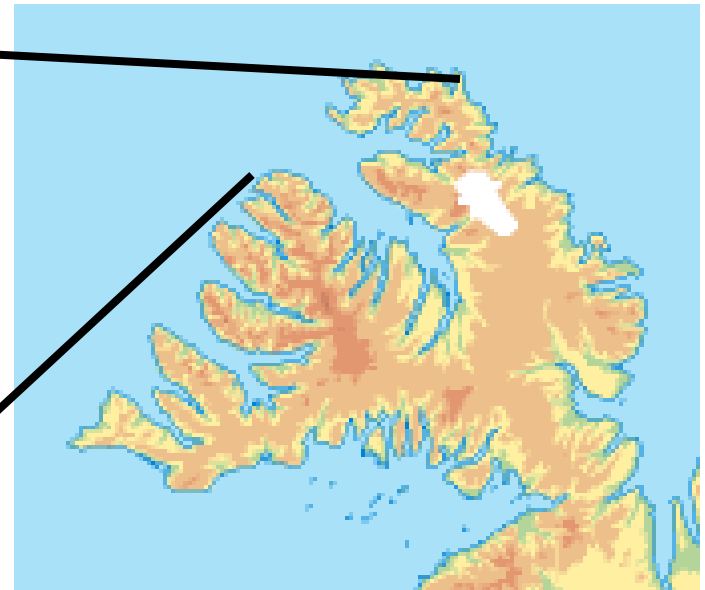
U^3



U^3



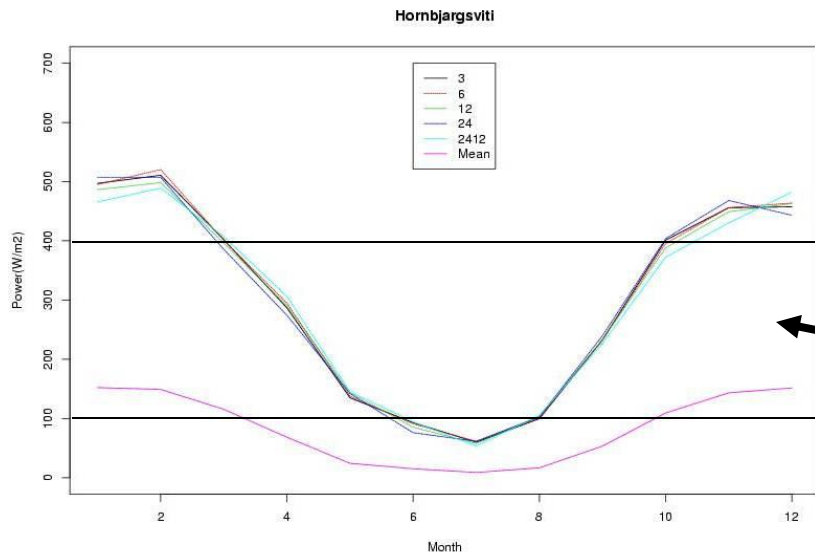
1950 1960 1970 1980 1990 2000



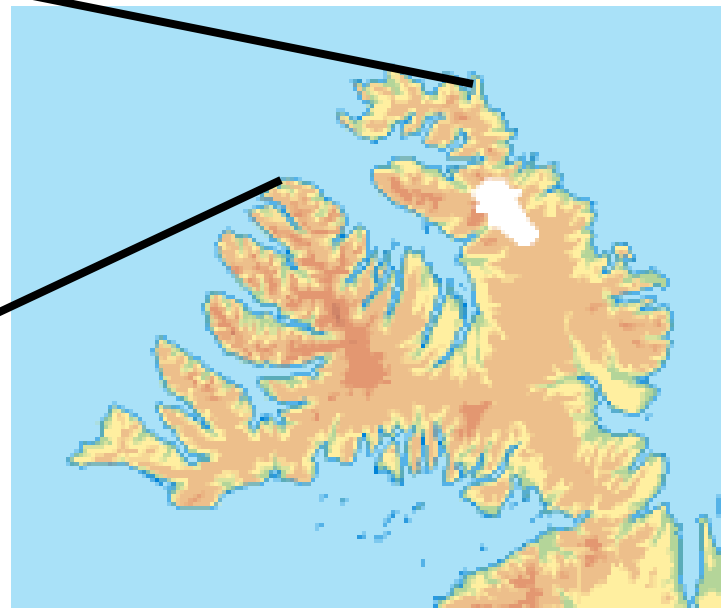
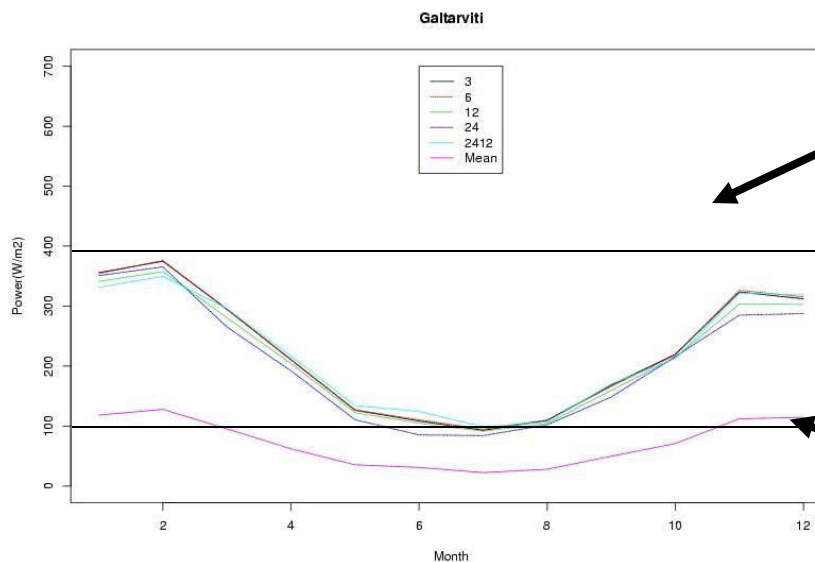
Þessi línurit eru alls ekki lík
hvert öðru!

Árstíðasveifla vindorkuflæðis á Galtarvita og Hornbjargsvita

U^3

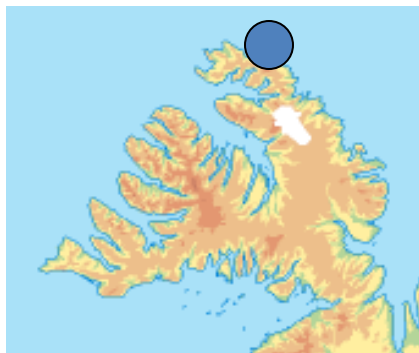
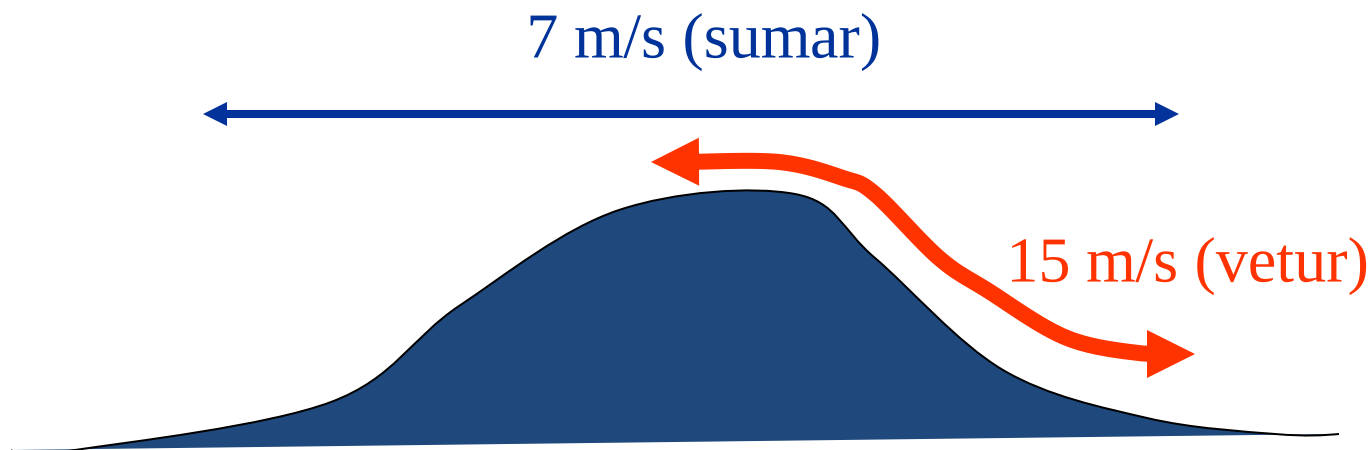


U^3

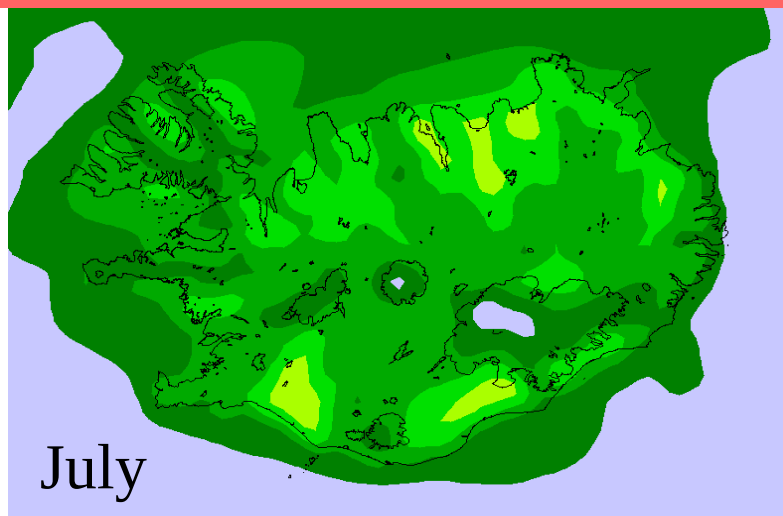
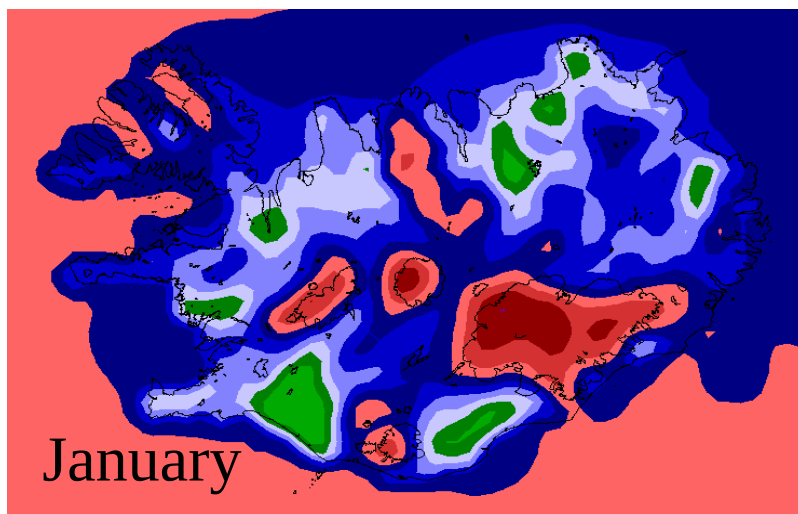


Orkuflæði meðalvindsins

Mynstrið er fall af árstíma



Reiknaður meðalvindur (30 ár, $dx=8\text{km}$)



Almennt:

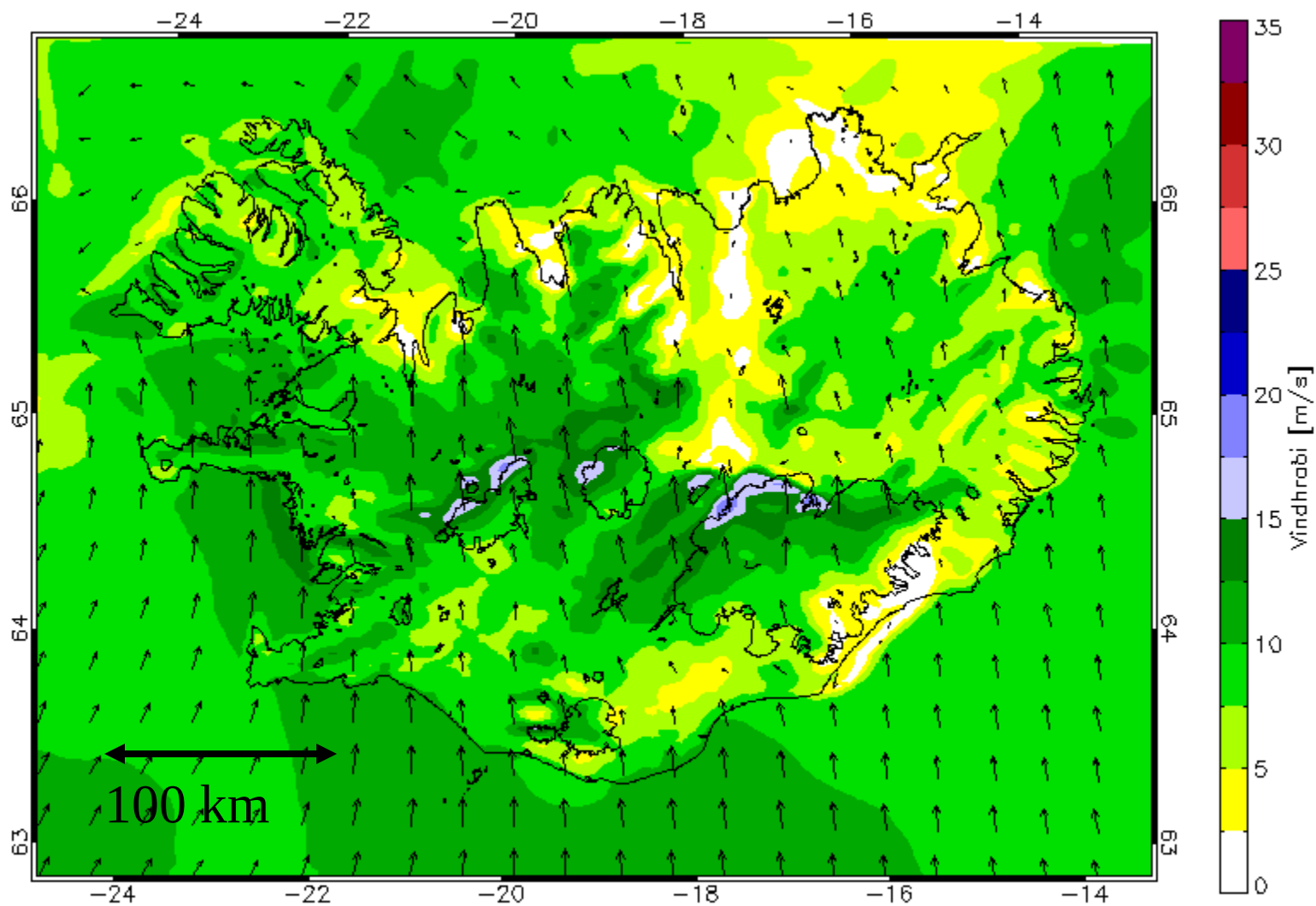
Hvassast á leið niður fjöll. Mikið skjól fyrir NA-landi

Vetur:

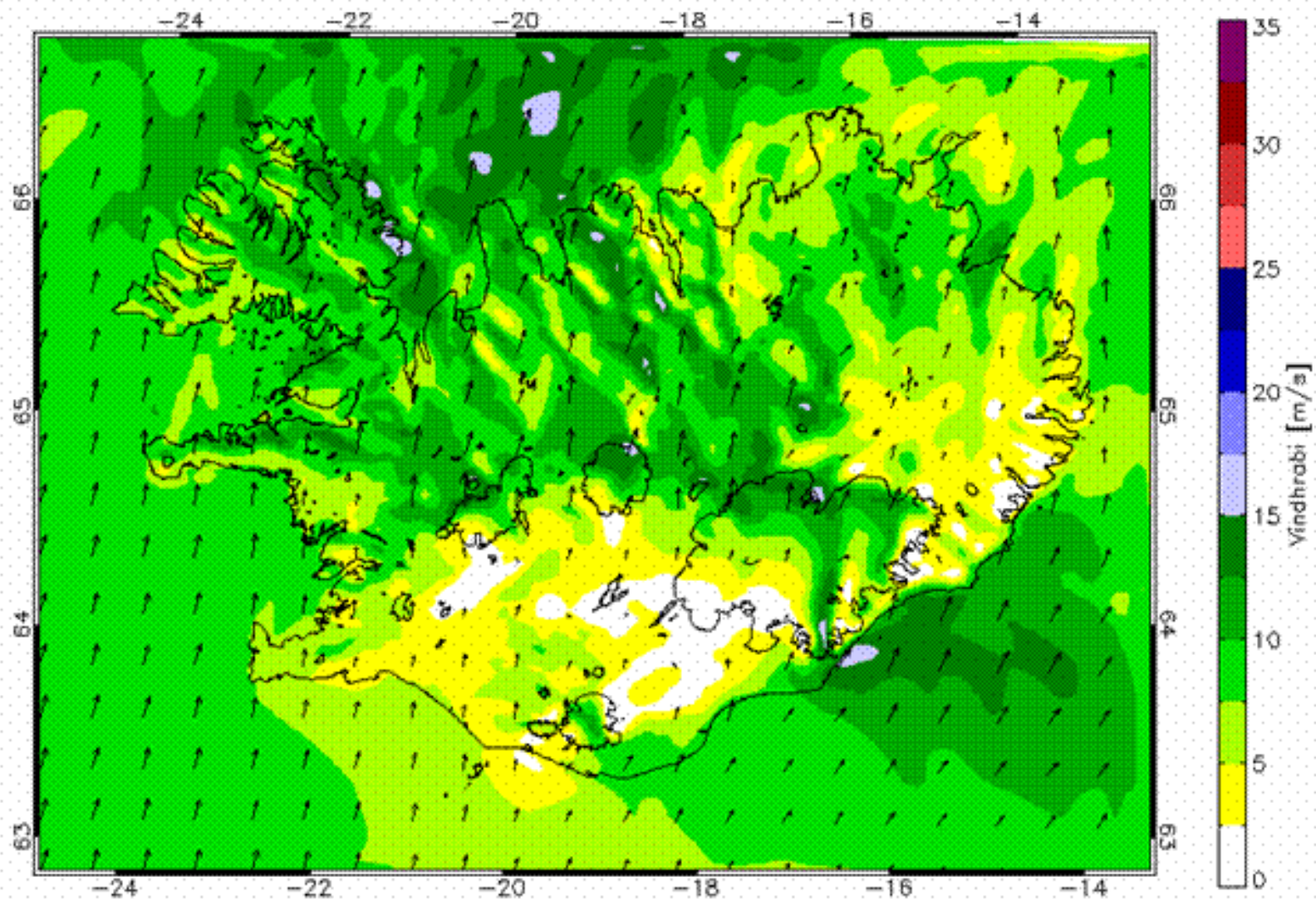
Hvassast til fjalla, en ekki á sjó

Sumar:

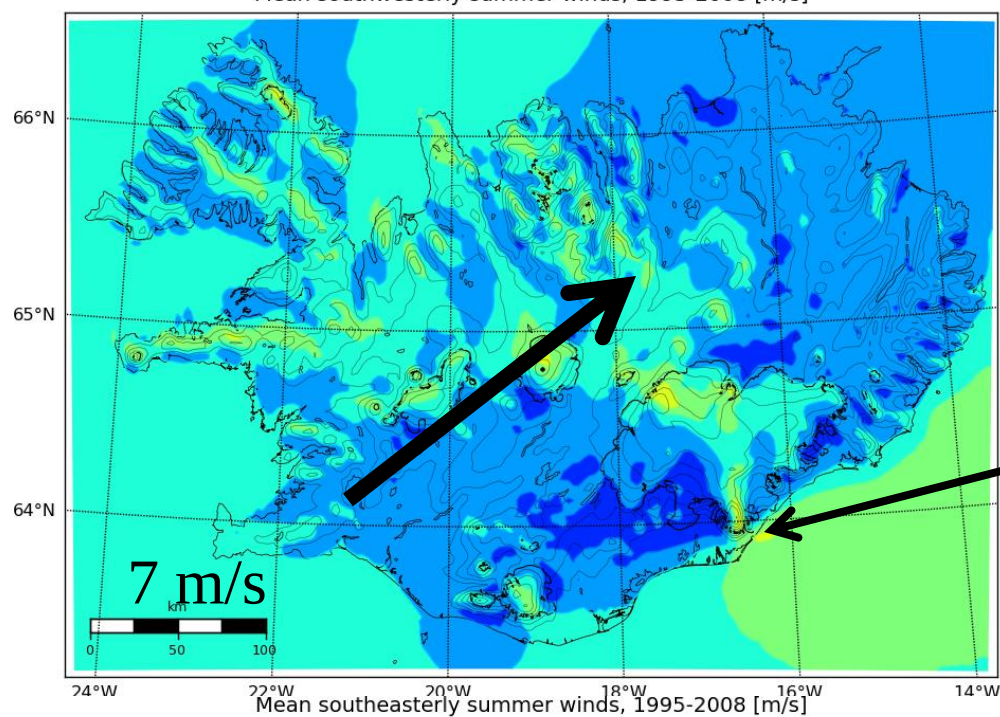
Strandskjól. Lítill munur á vindi á láglendi og til fjalla



Gildir mánuðaginn 05.06.06 kl. 09:00 (04.06.06 kl. 00:00 +33 klst.)

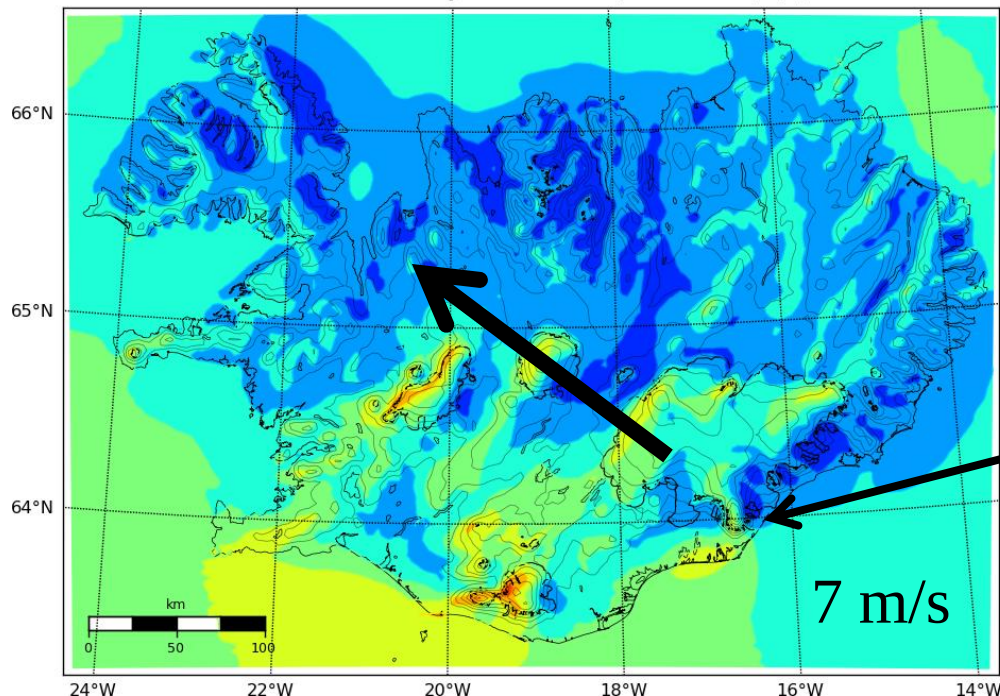


Mean southwesterly summer winds, 1995-2008 [m/s]



Meðalvindhraði á sumrin í
SV- og SA-átt (úr RÁV-
inu)

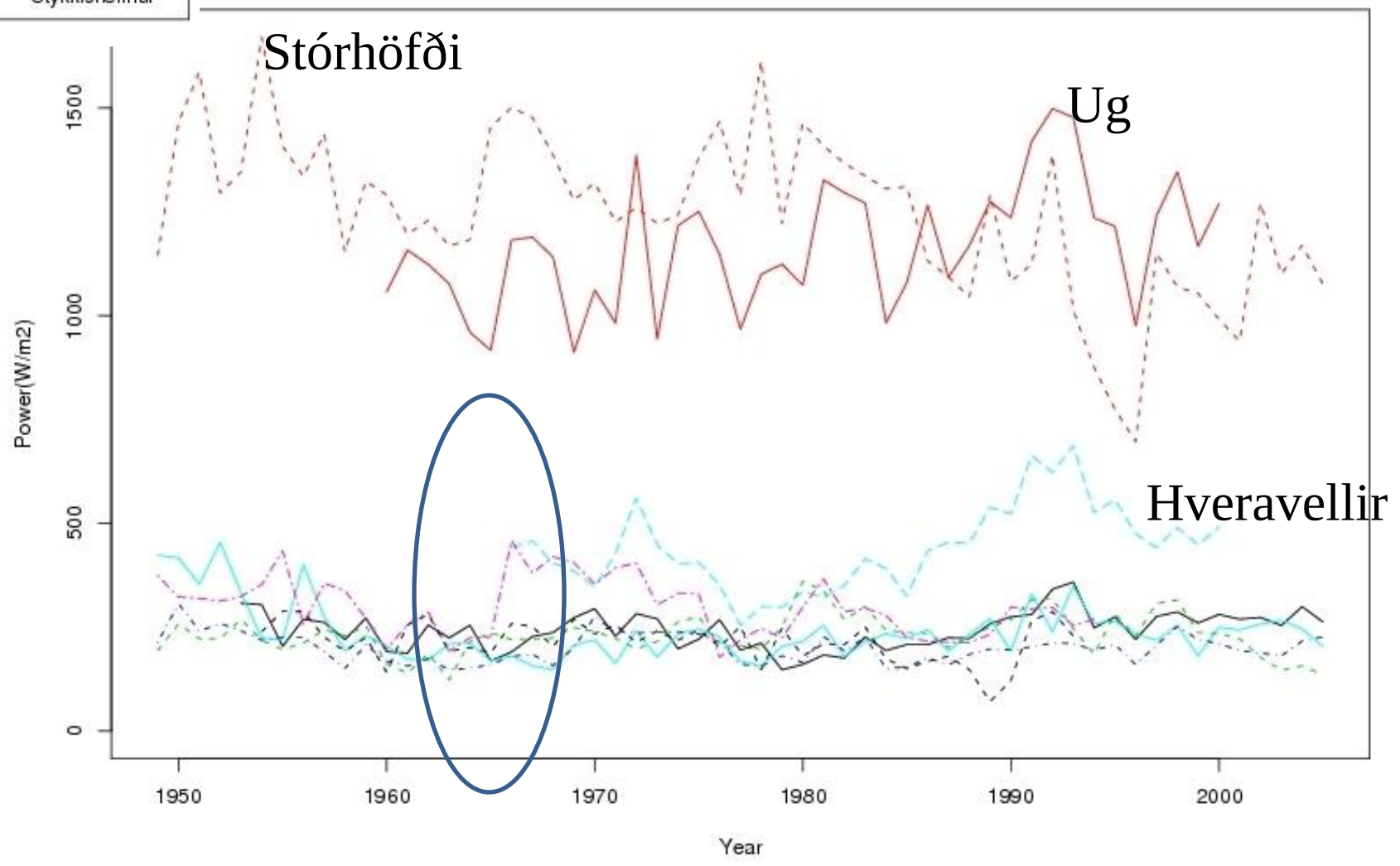
11 m/s



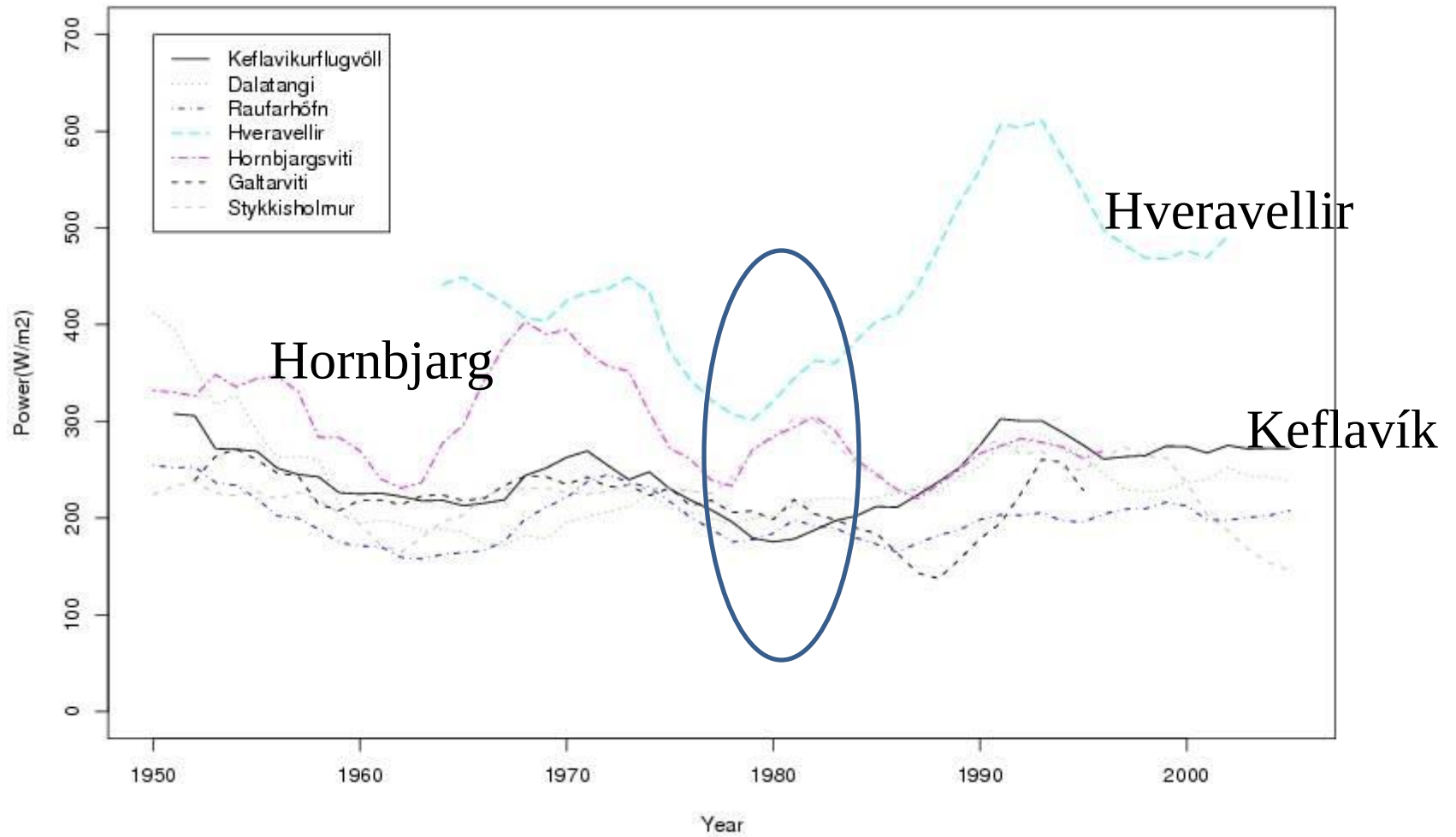
5 m/s

- Keflavikurlugvöll
- Dalatangi
- - - Raufarhöfn
- - - Hveravellir
- - - Hornbjargsviti
- - - Galtarviti
- - - Stykkisholmur

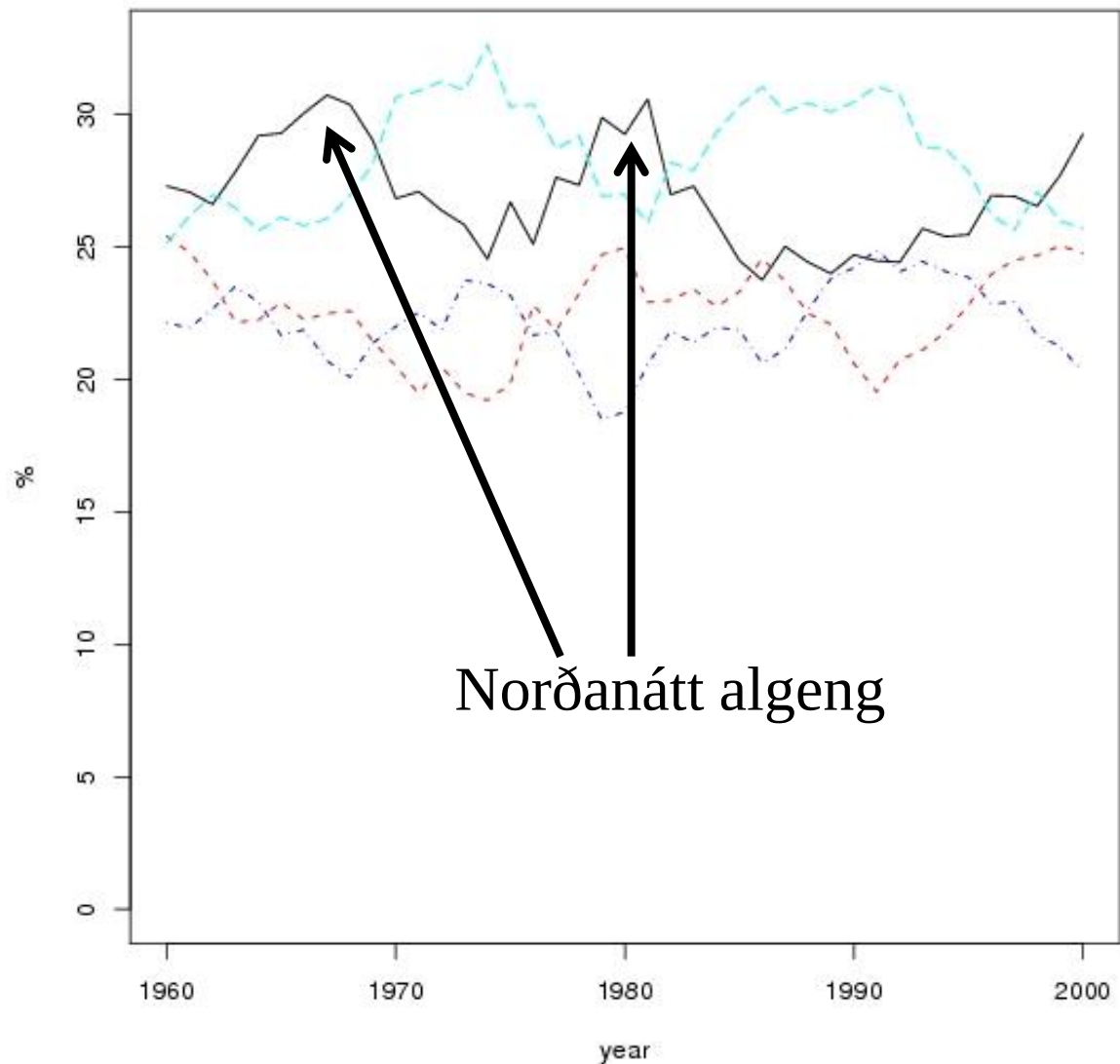
Power=f(Year)



Power=f(Year)



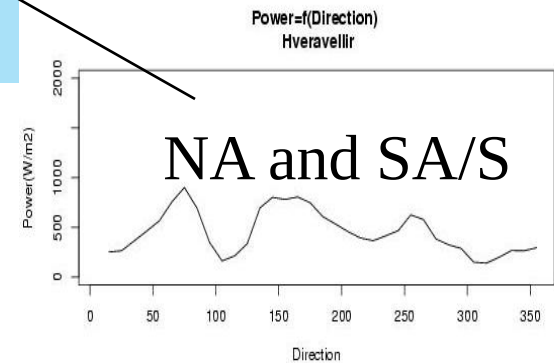
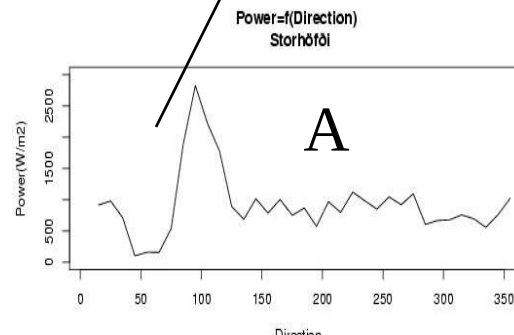
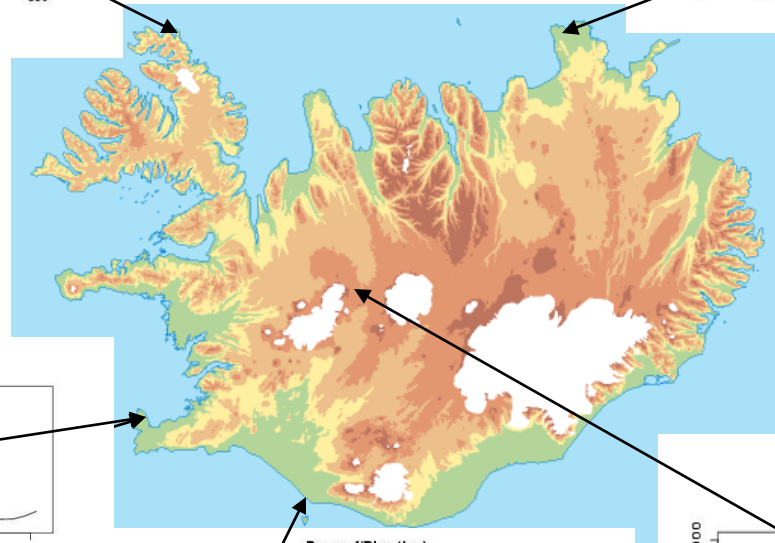
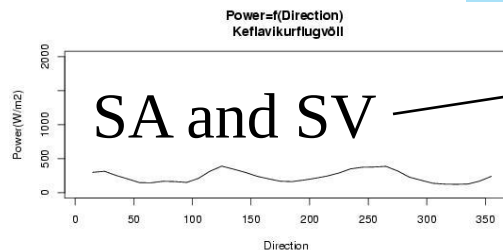
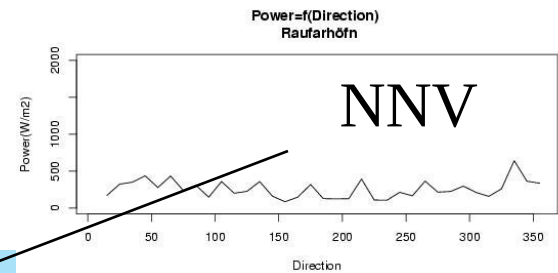
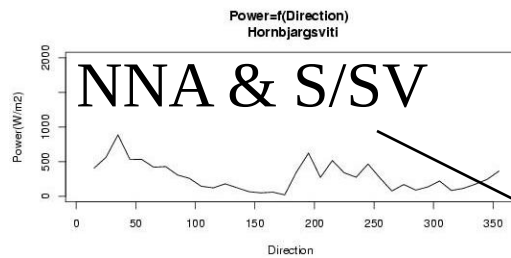
Frequency of each direction, 915



Tíðni
þrýstivindátta
yfir landinu
(ECMWF)

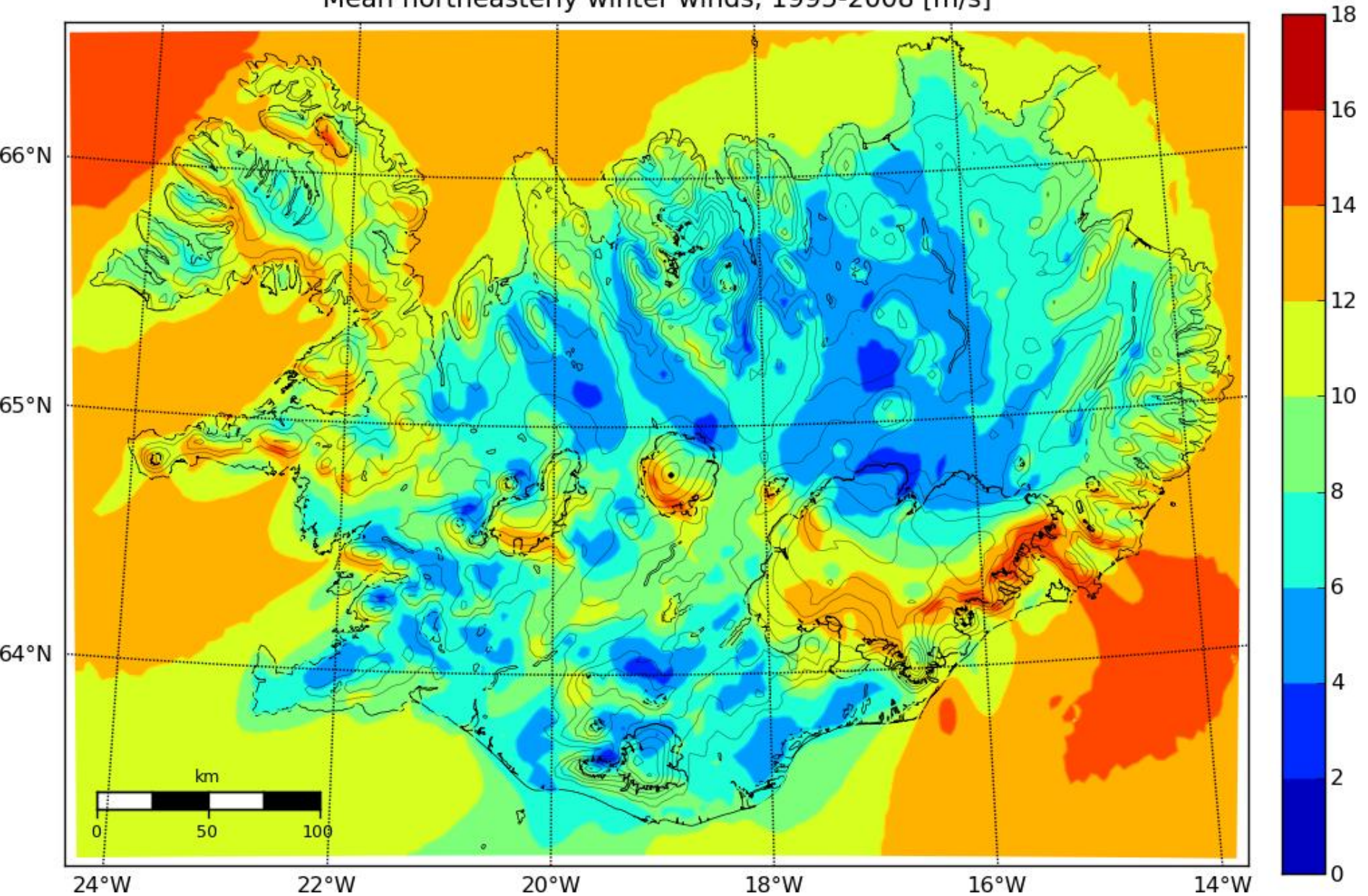
1960 1970 1980 1990 2000

Vindorkuflæði í ýmsum áttum á nokkrum stöðum á Íslandi



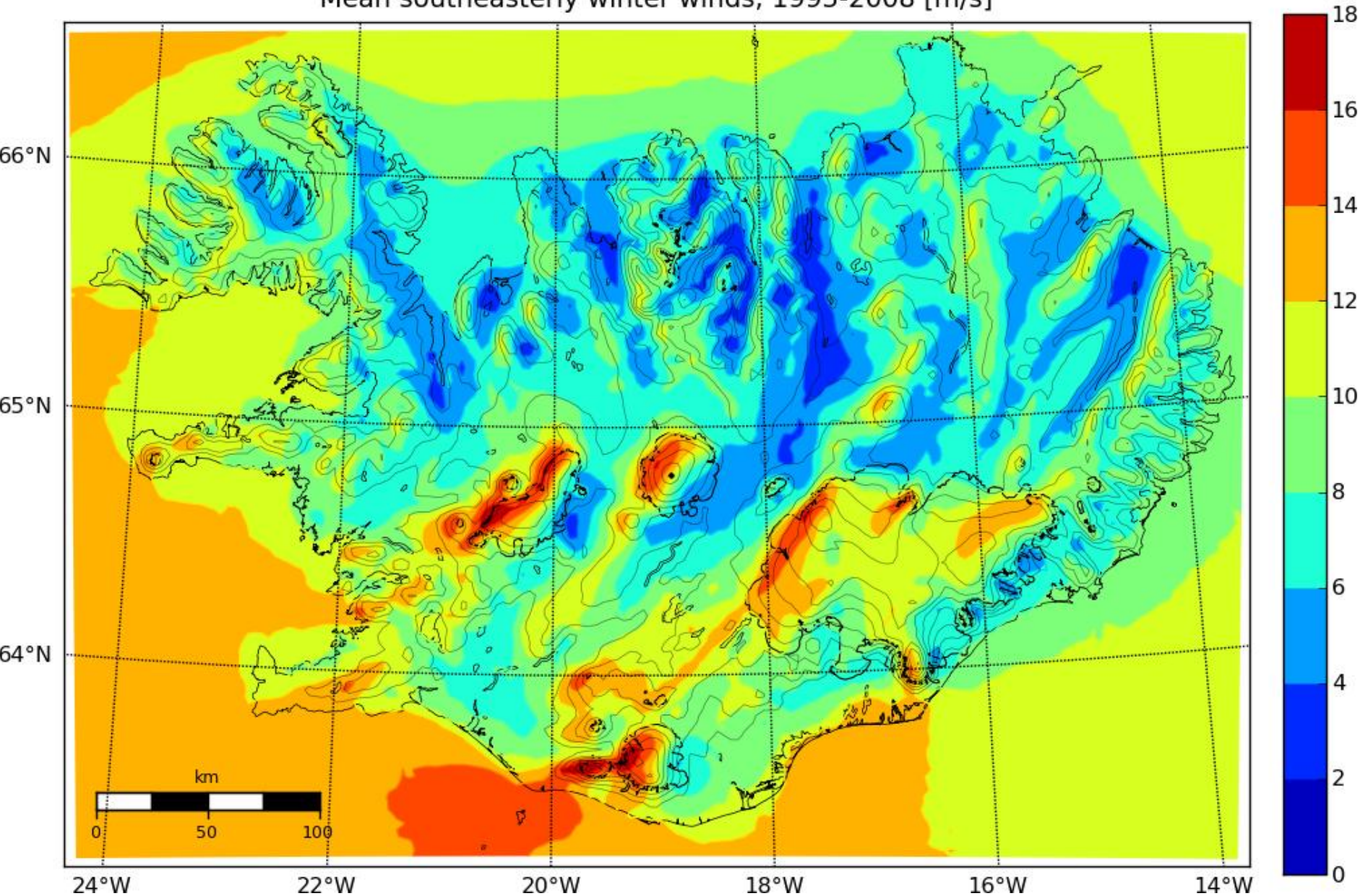
Meðalvindhraði í NA-átt að vetrarlagi (RÁV)

Mean northeasterly winter winds, 1995-2008 [m/s]



Meðalvindhraði í SA-átt að vetrarlagi (RÁV)

Mean southeasterly winter winds, 1995-2008 [m/s]



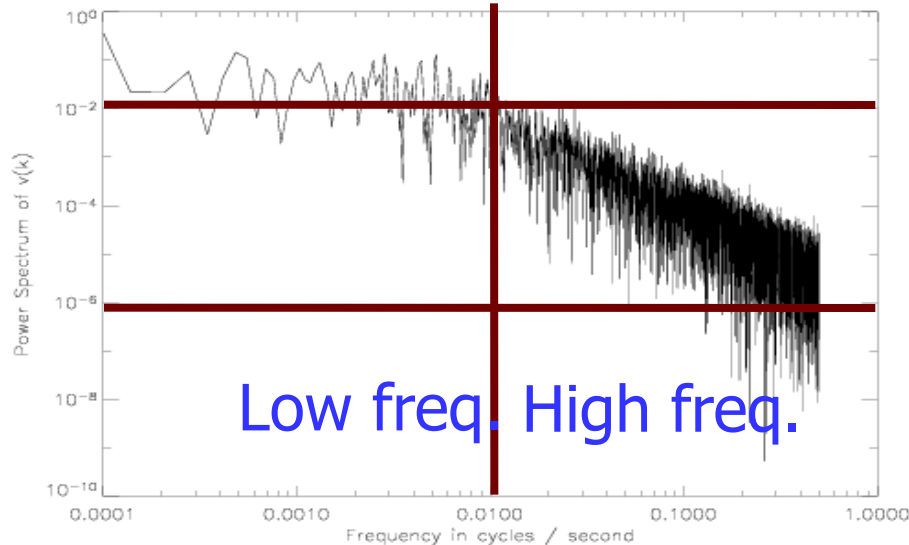
Breytileiki í tíma er illa hermdur

Orka sem fall af tíðni sveiflna í vindi:

Mælt

3 klst

100 s



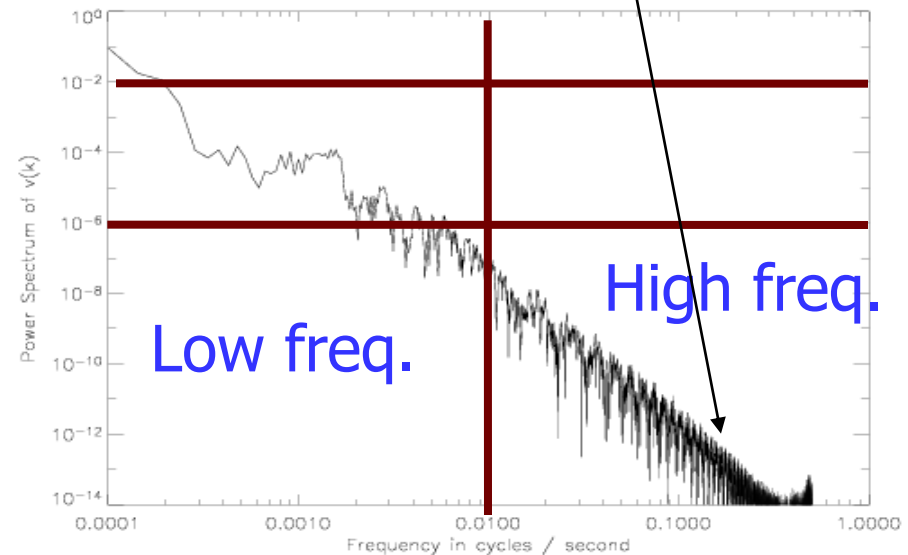
Tíðni

Hviður týnast!

Reiknað

3 klst

100 s



Tíðni

Meðalskekkja vindhraða minnkar ekki alltaf með þéttara neti

Stasjonsnavn	Gjennomsnittsfeil (MBE)			Gjennomsnittlig absoluttfeil (MAE)		
$\Delta x =$	1 km	3 km	9 km	1 km	3 km	9 km
Alta	-0.8	-0.2	-1.5	1.9	1.6	1.9
Hammerfest	-5.0	-6.2	-5.0	5.7	6.2	5.2
Fruholmen	-0.8	-0.6	-1.7	1.9	1.9	2.4
Banak	1.4	1.6	1.2	3.0	2.9	2.6
Honningsvåg	-4.3	-4.5	-2.3	4.5	4.7	3.0
Mehamn	3.1	2.0	1.7	4.1	3.3	3.1
Slettnes	0.8	0.6	-0.3	3.5	3.3	3.4
Berlevåg	6.5	5.4	1.8	7.1	6.4	4.8
Karasjok	-1.1	-1.6	-3.0	1.4	1.9	3.1
Suolovuopmi	-0.5	-0.8	-1.7	1.5	1.5	1.9
Gjennomsnitt	-0.1	-0.4	-1.1	3.5	3.4	3.1

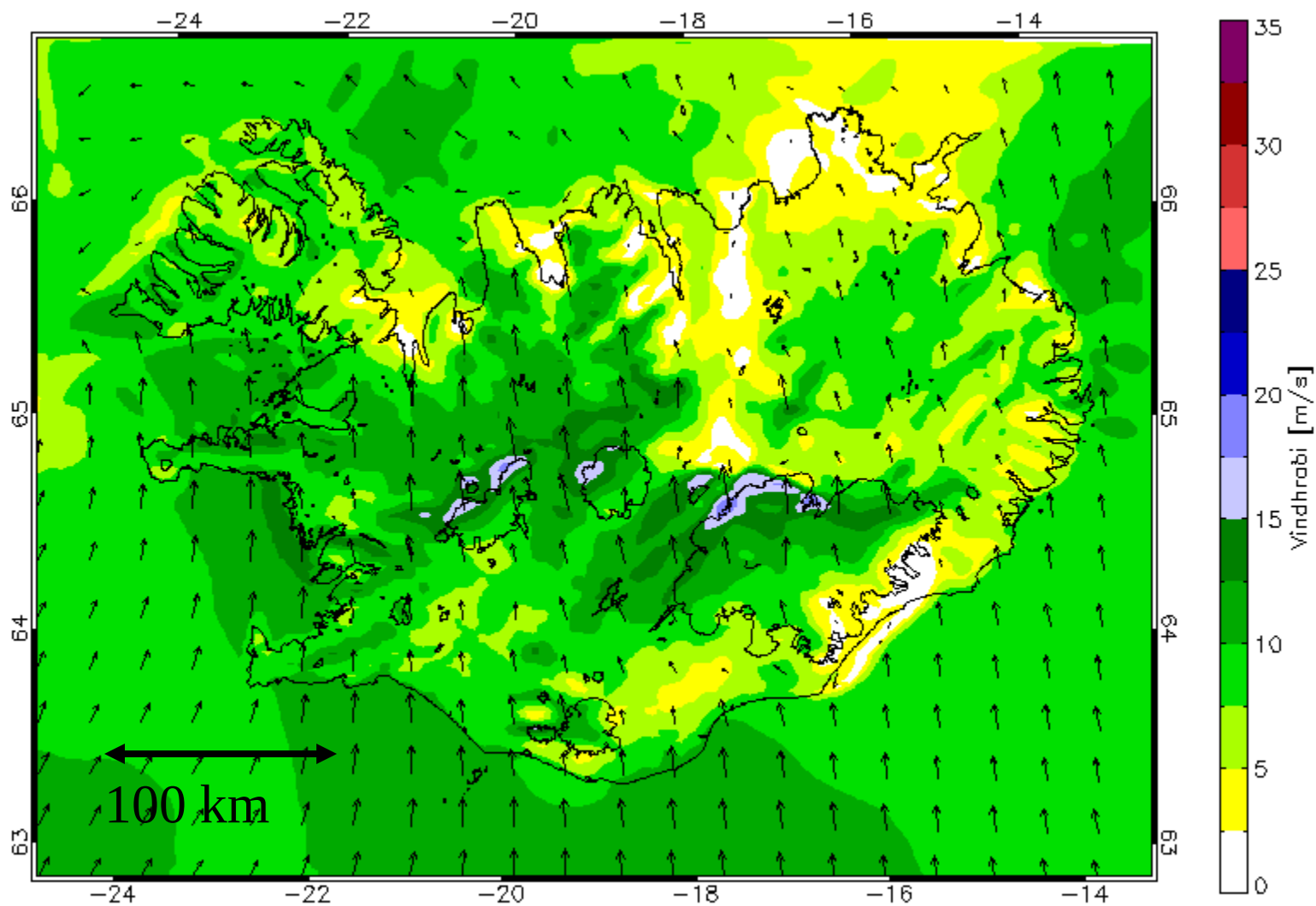
10 weather stations and mean of all stations

E. Samuelsen, 2007

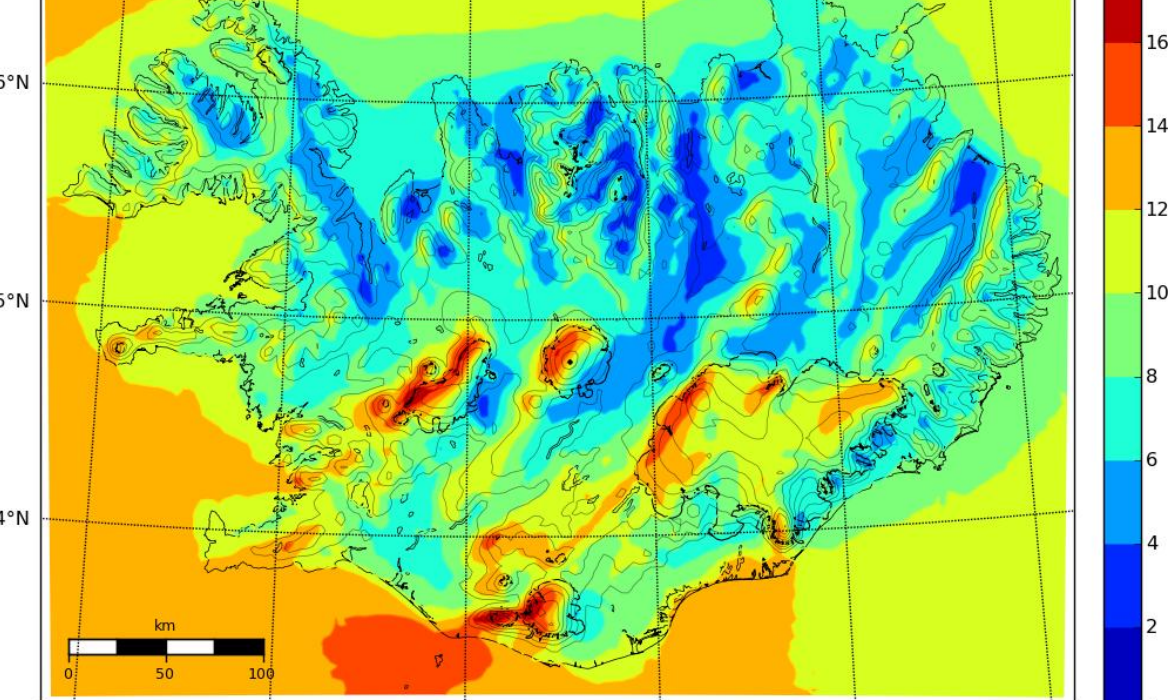
Um vindorkubisniss á Íslandi:

“The economical calculation has given disappointing results regarding the feasibility of raising a wind farm in Iceland. It is unlikely within the nearest future that the electricity price increases to a level of 4000 ISK/MWh or more. The results from the calculation in Table 8 shows that the profitability is limited even when the price is set at this high level and the cost factors including the discount rate set at a minimum.”

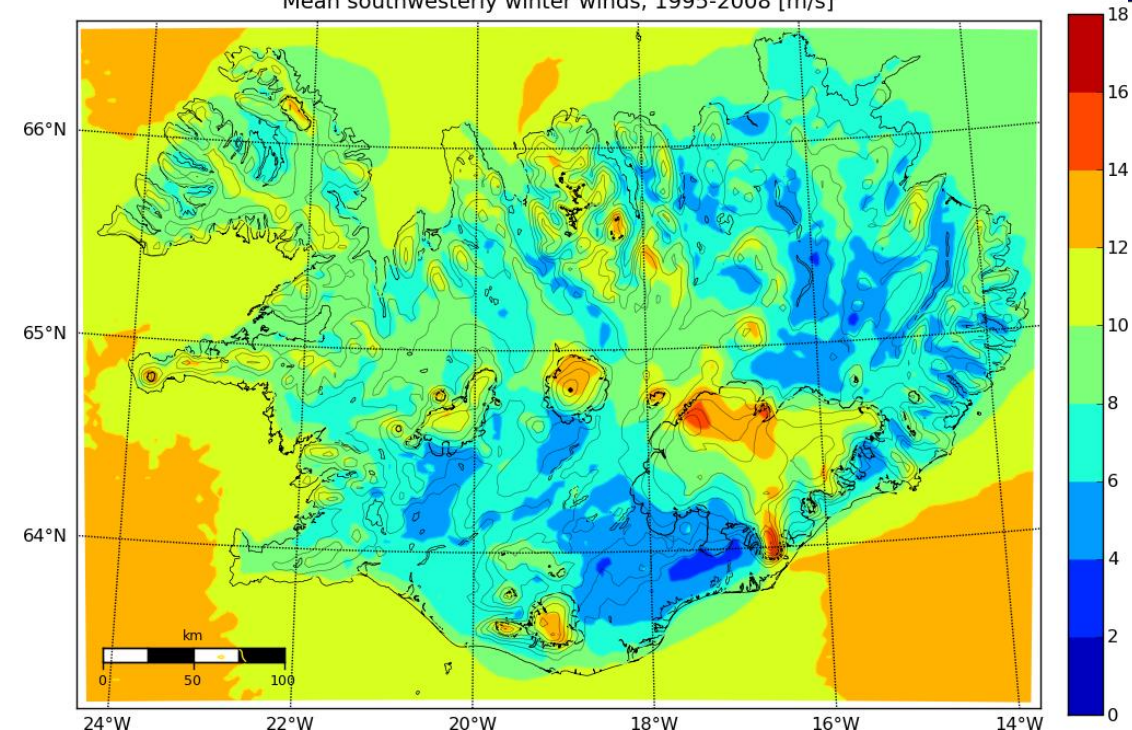
Smári Jónsson, 2008

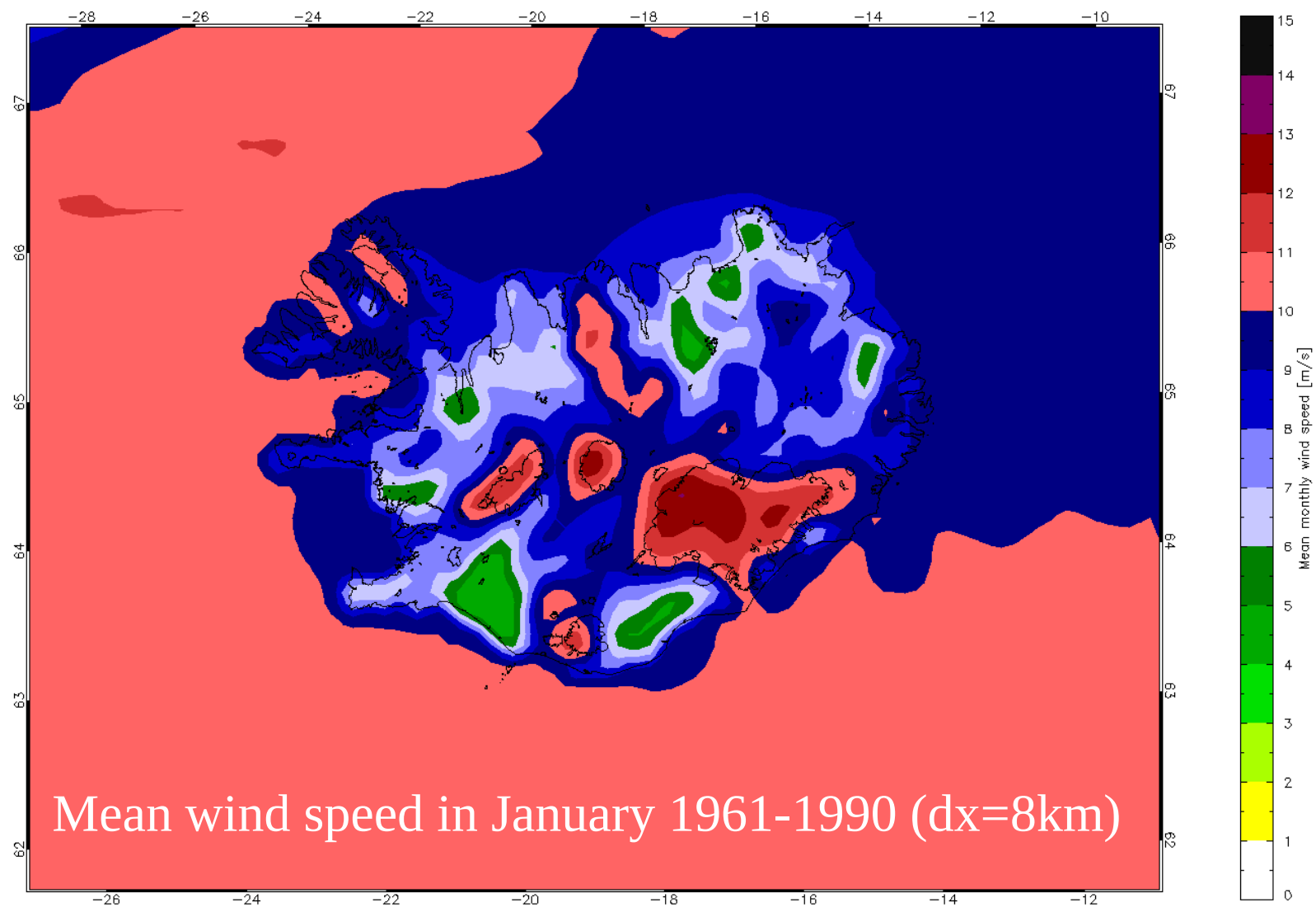


Gildir mánuðaginn 05.06.06 kl. 09:00 (04.06.06 kl. 00:00 +33 klst.)

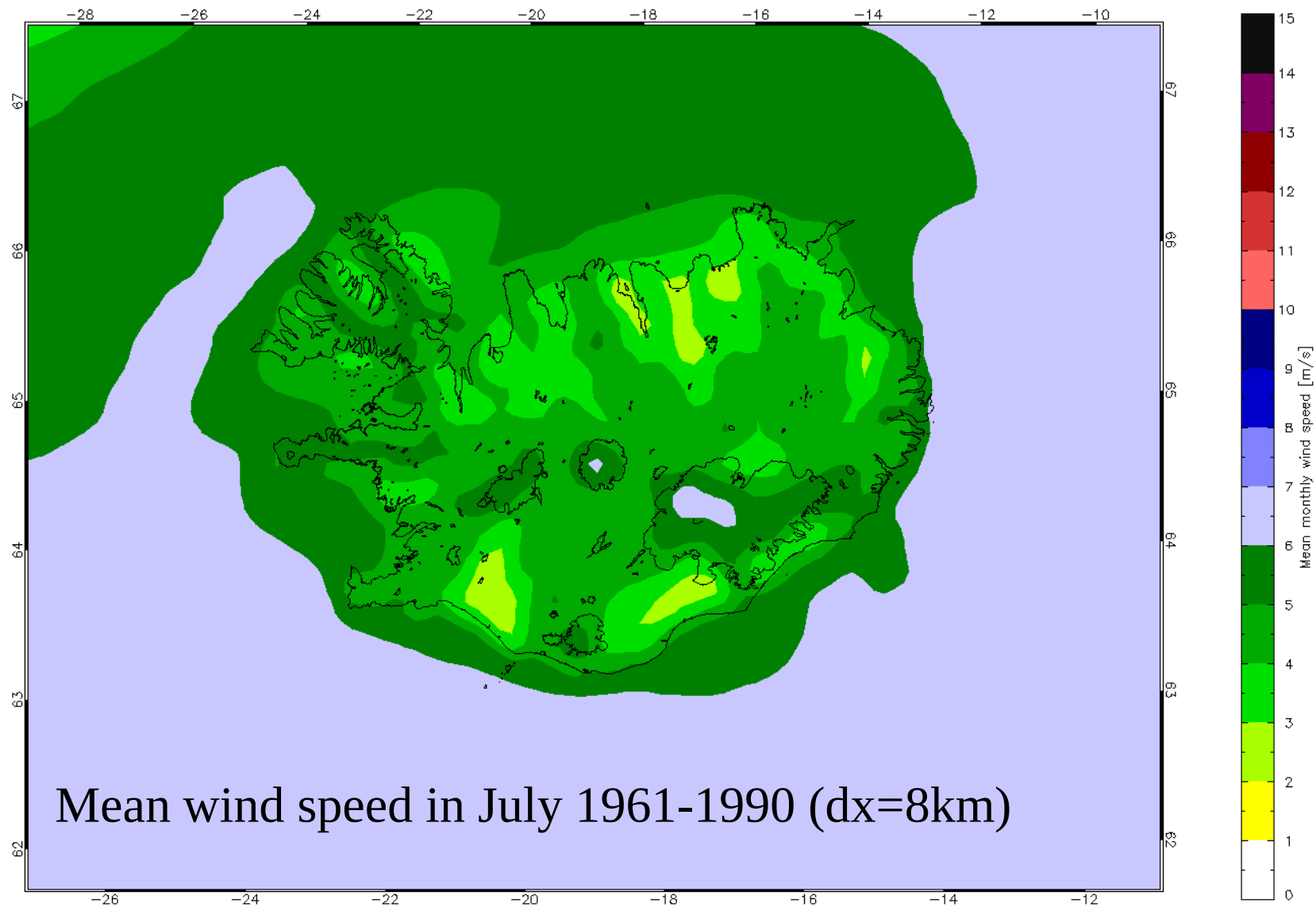


Mean southwesterly winter winds, 1995-2008 [m/s]



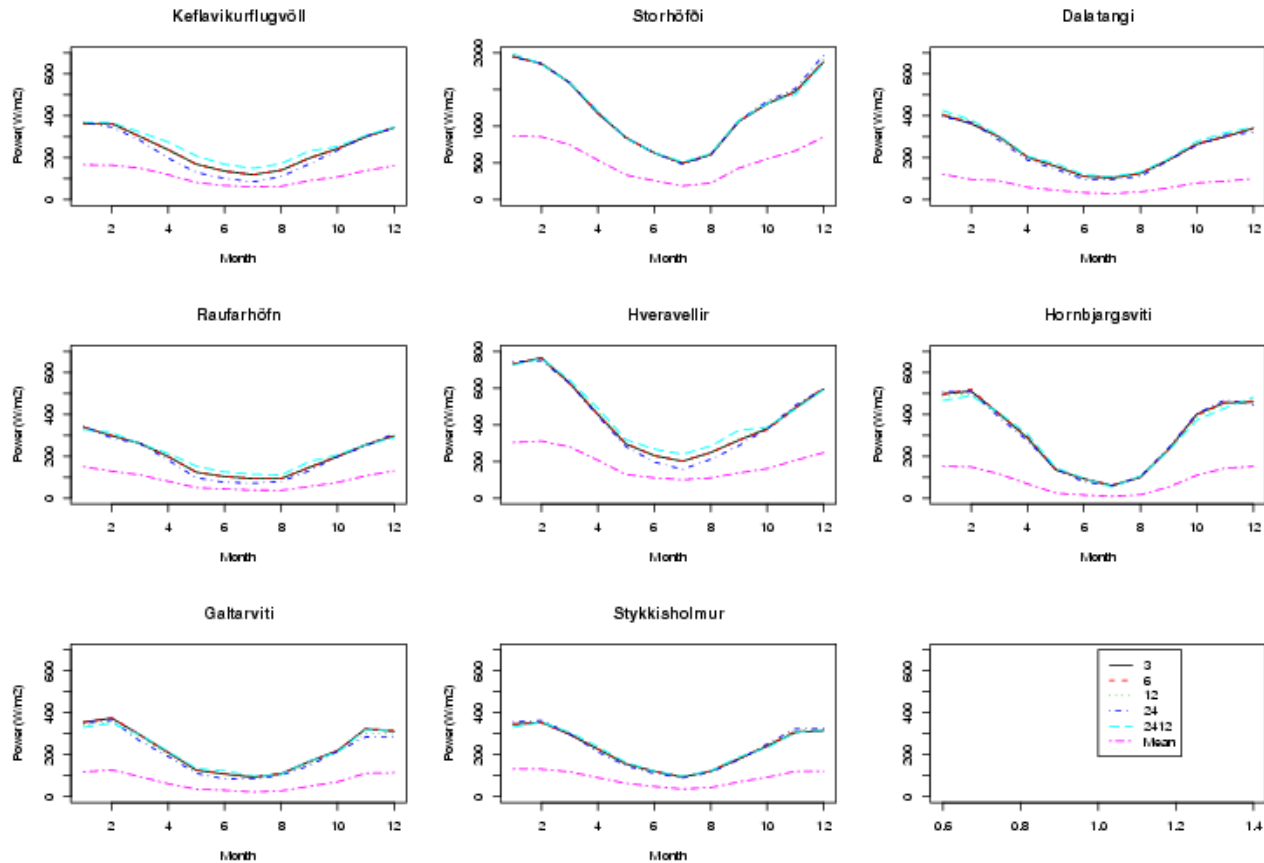


January 1961-90

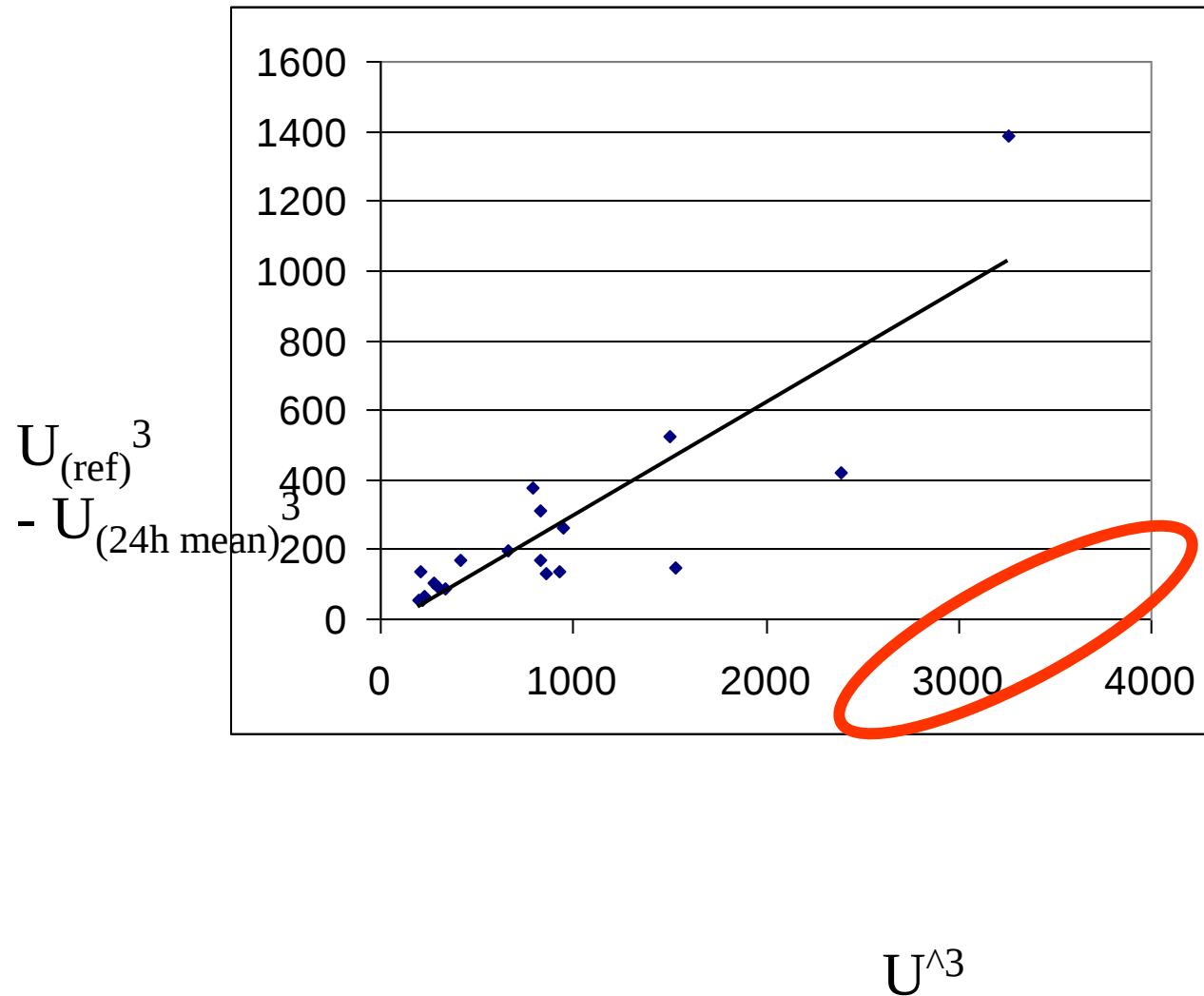


July 1961-90

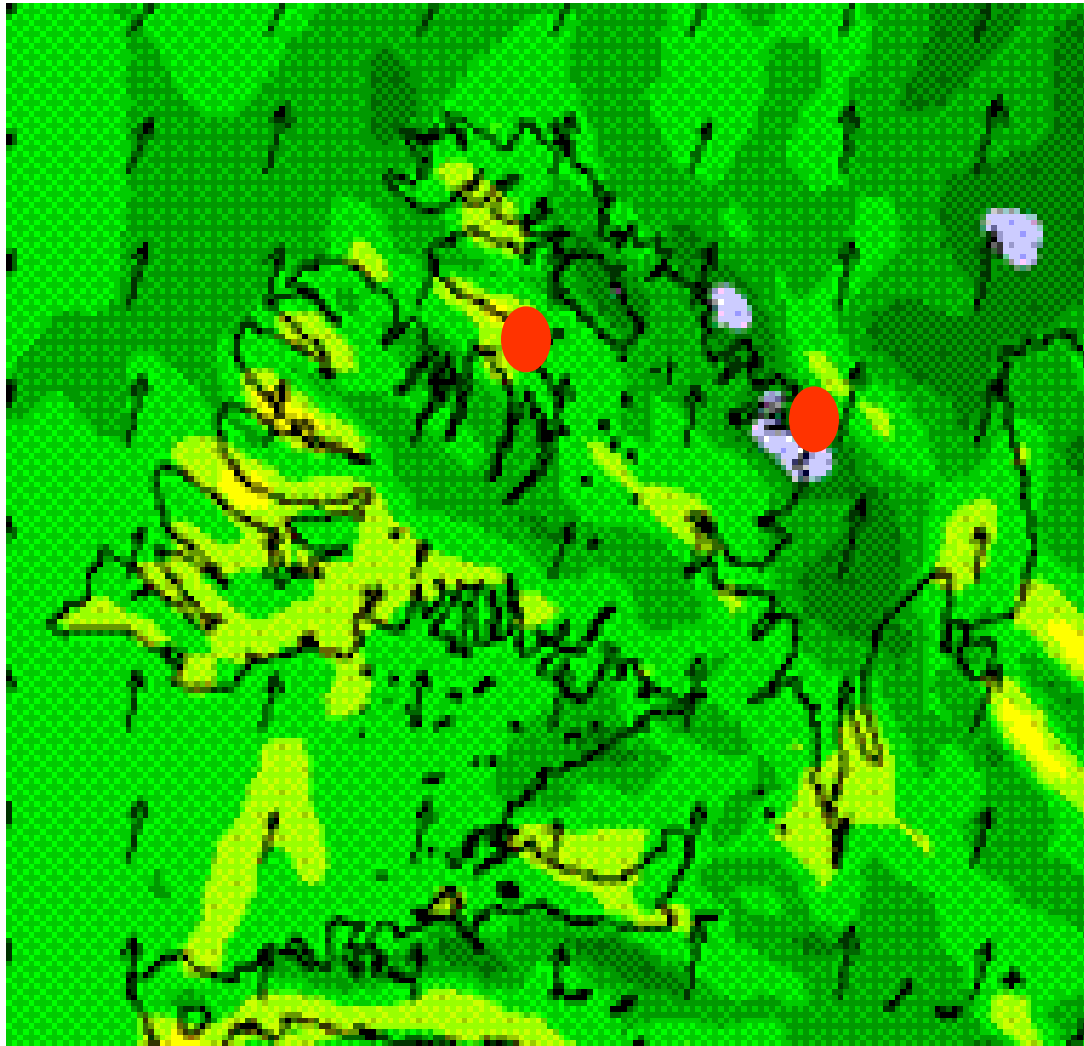
The seasonal cycle (blue lines: 10 min obs – violet lines: monthly means)



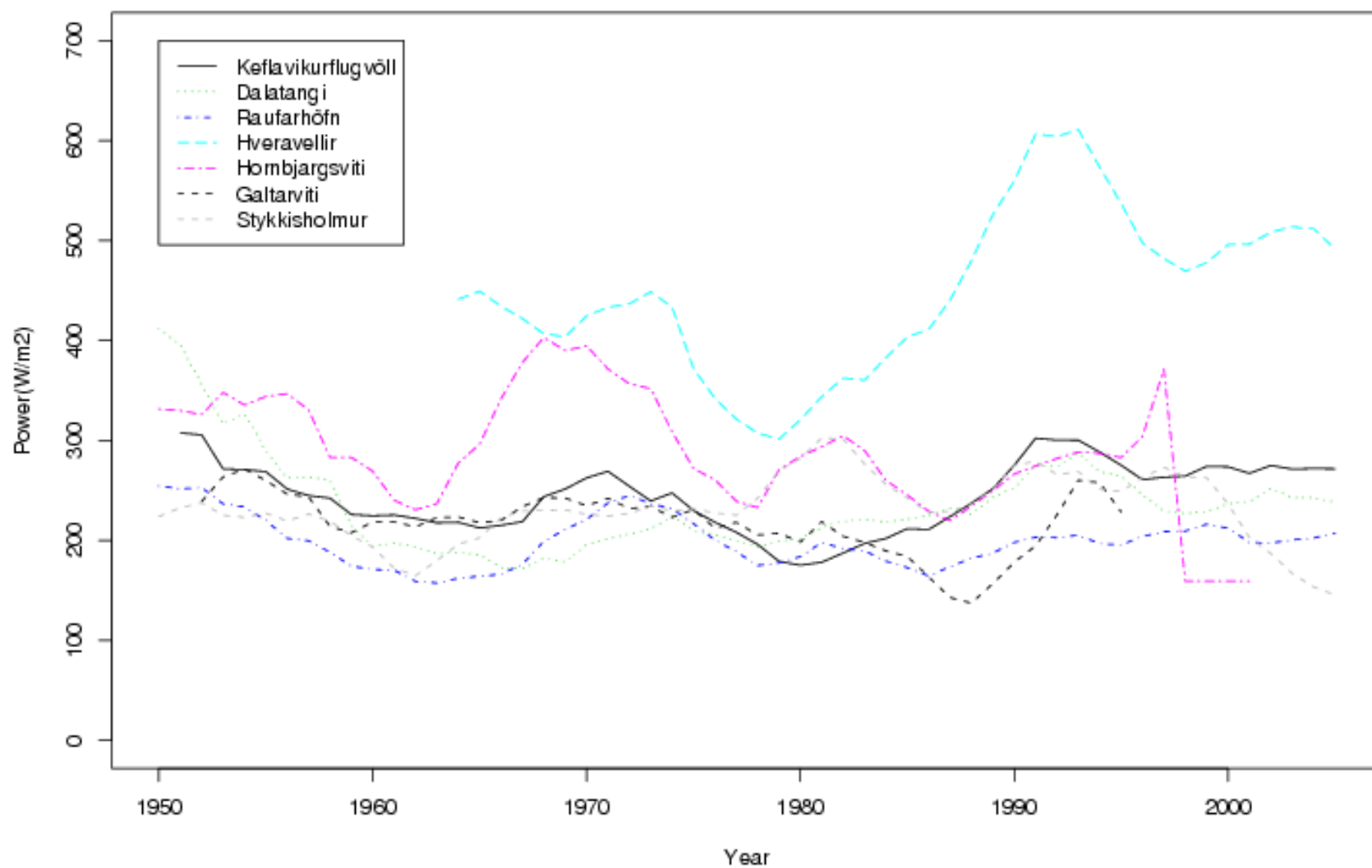
Can we use the **daily** mean wind speeds?

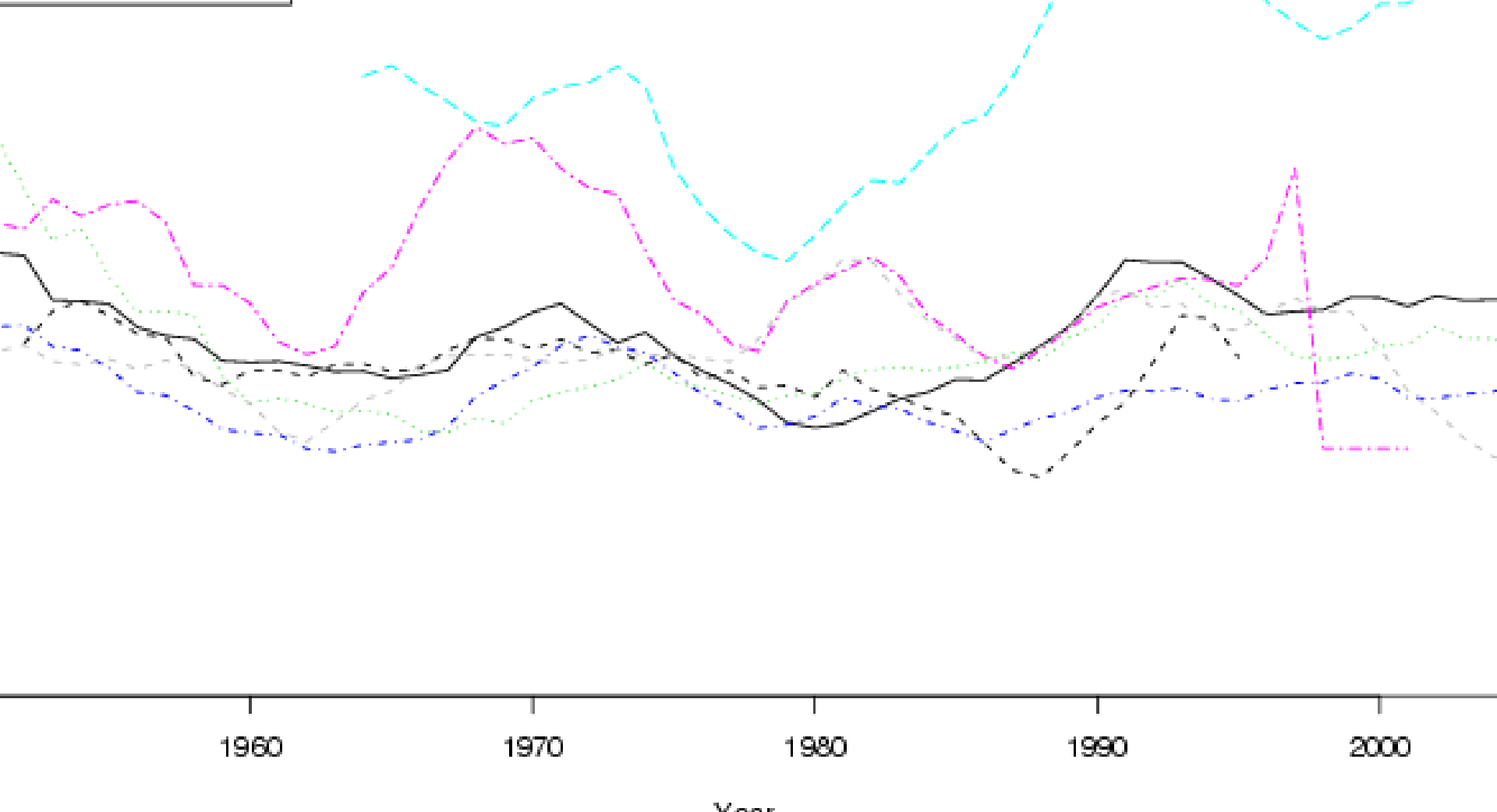


Difference between power calculations based on daily mean winds and 10 min means appear to be smallest where downslope winds are dominant



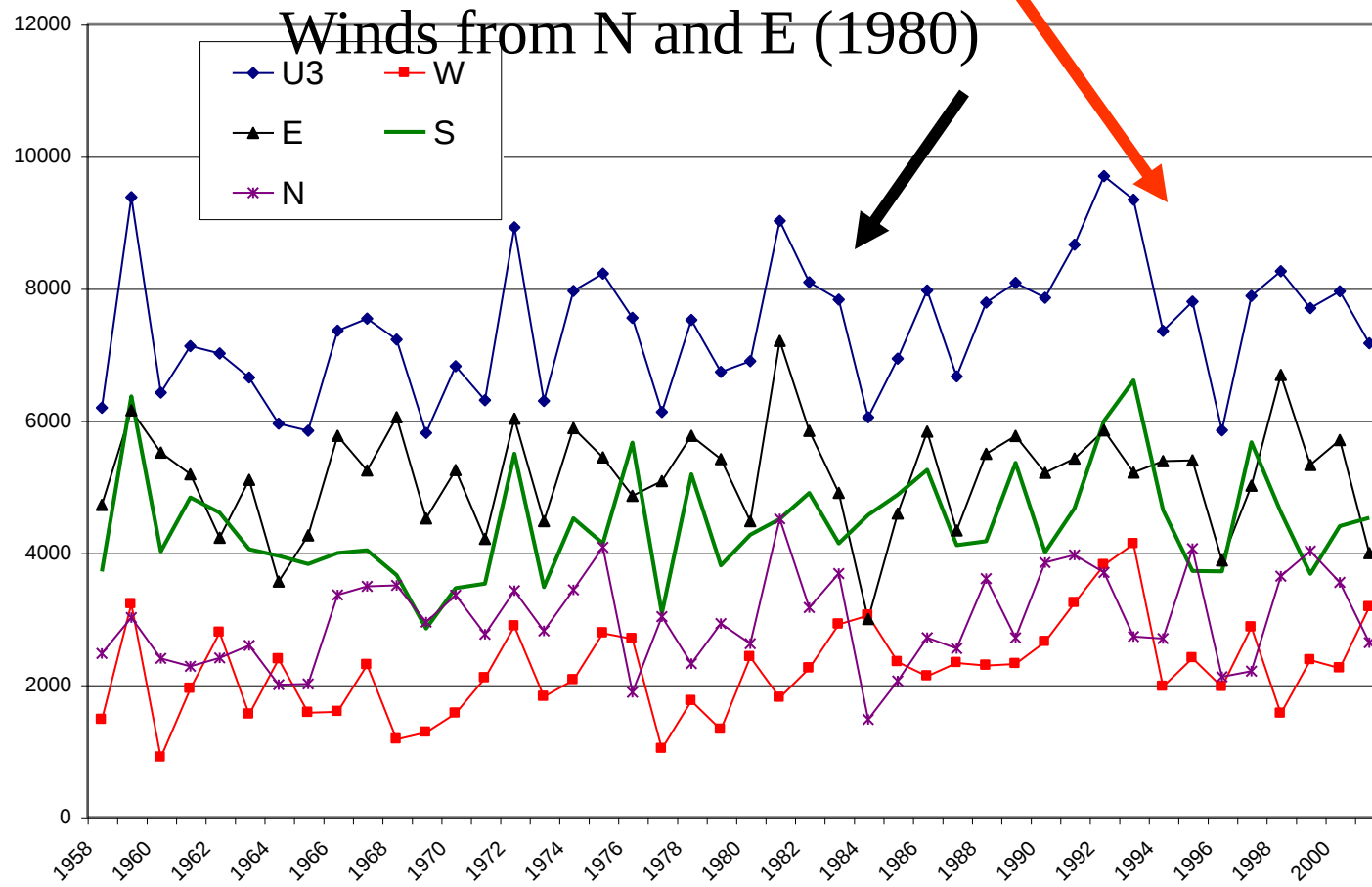
Power=f(Year)



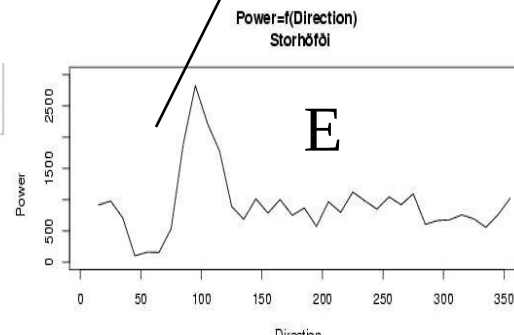
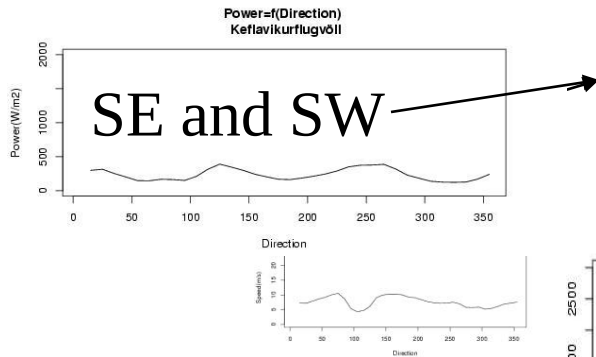
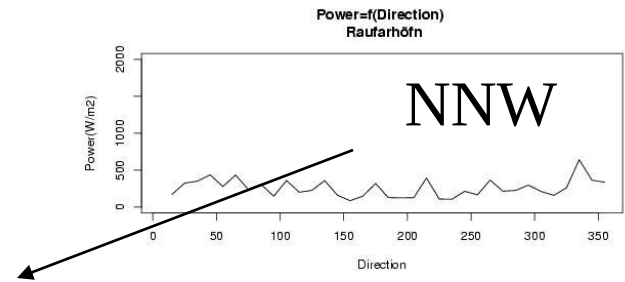
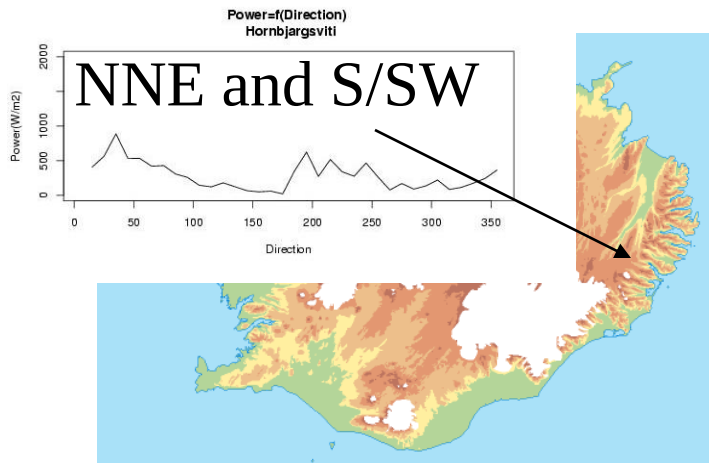


Geostrophic wind power 1958-2001

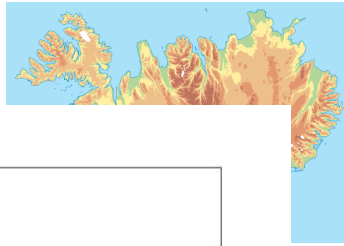
Winds from S and W (1991)



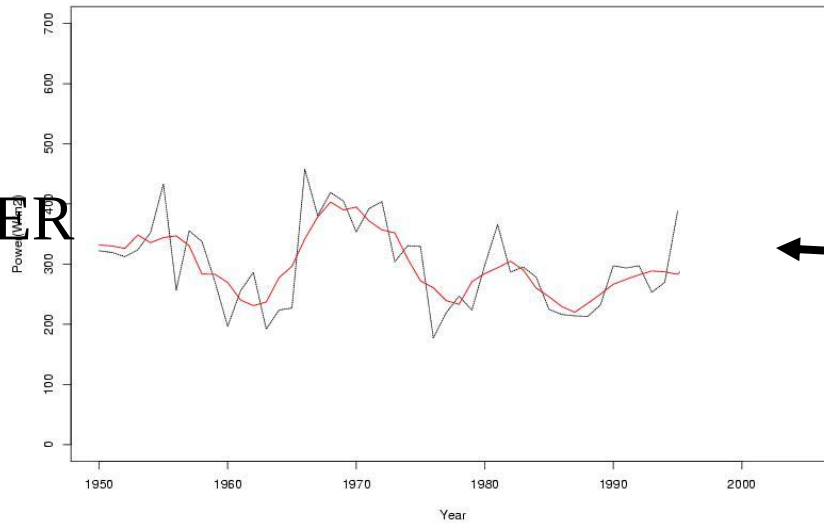
Wind power in different wind directions



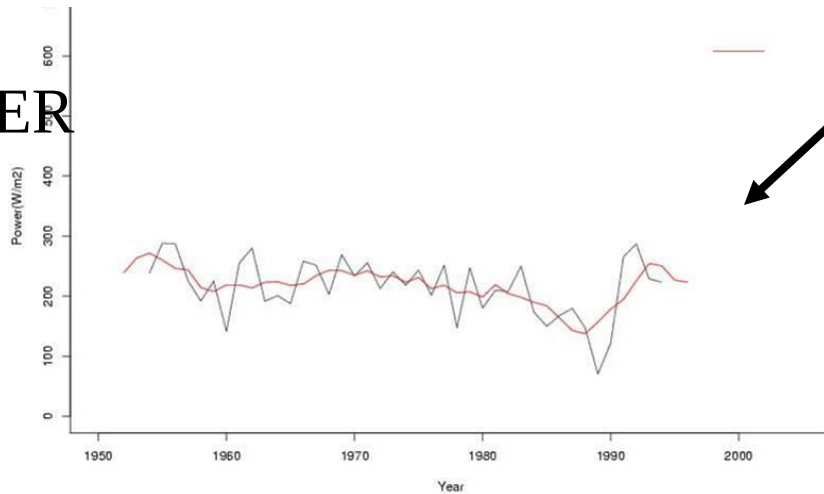
NE and SE/S



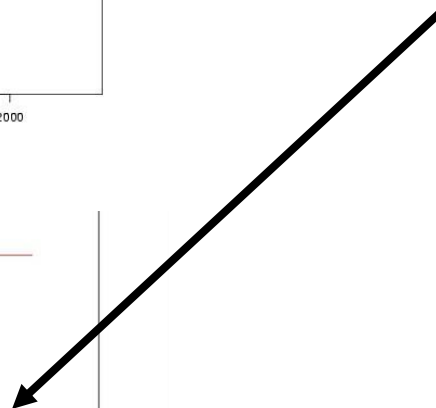
Hornbjargsviti



POWER



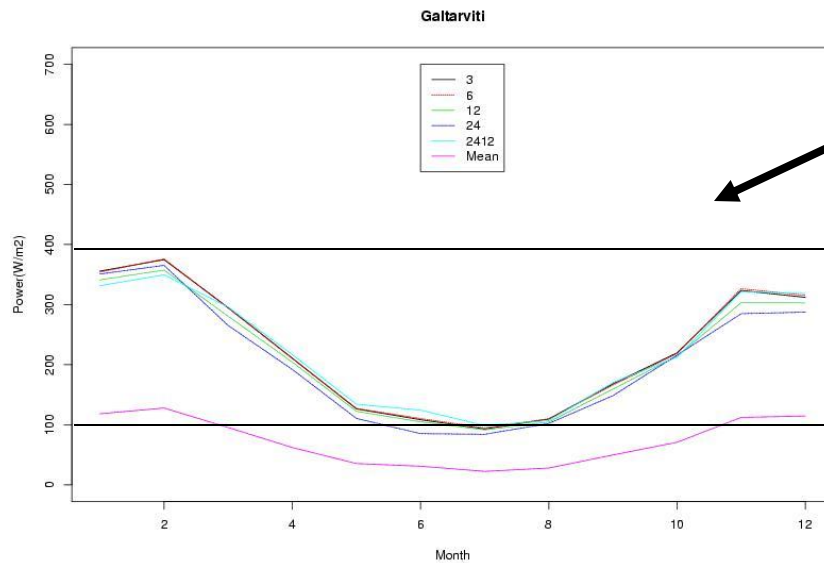
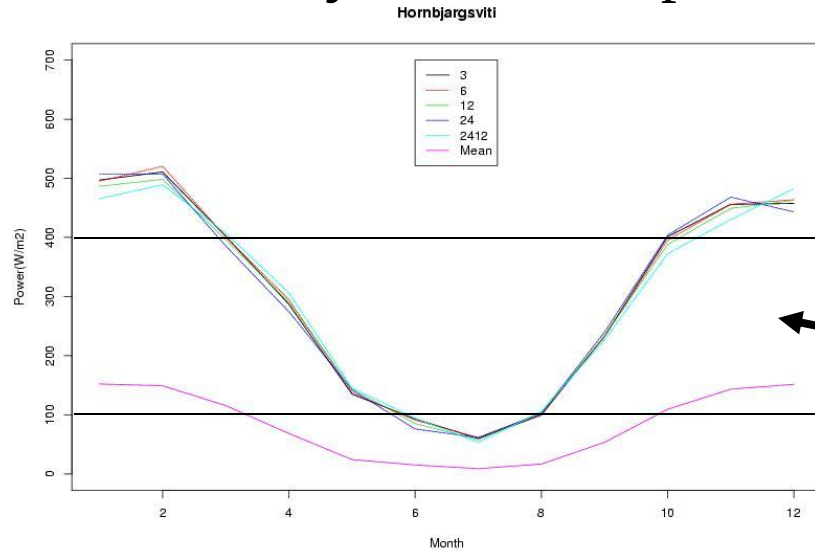
POWER



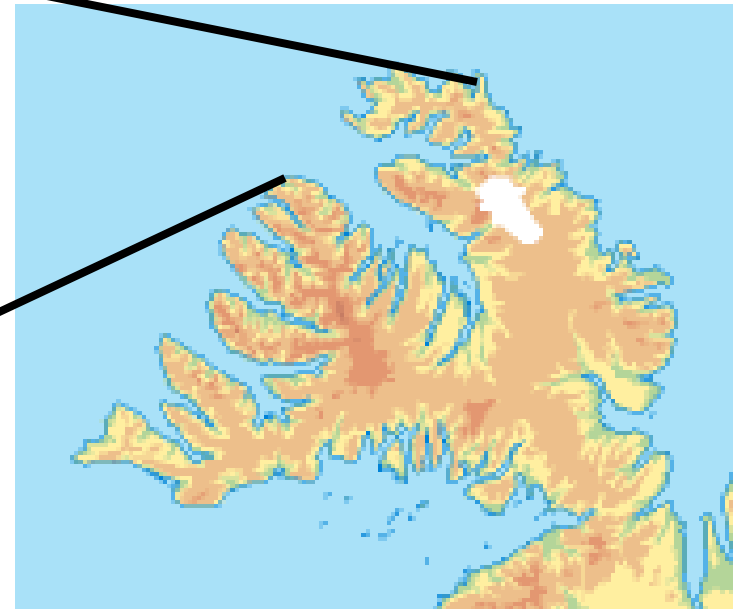
Time evolution of wind power at 2 locations in NW Iceland (1955-1995)

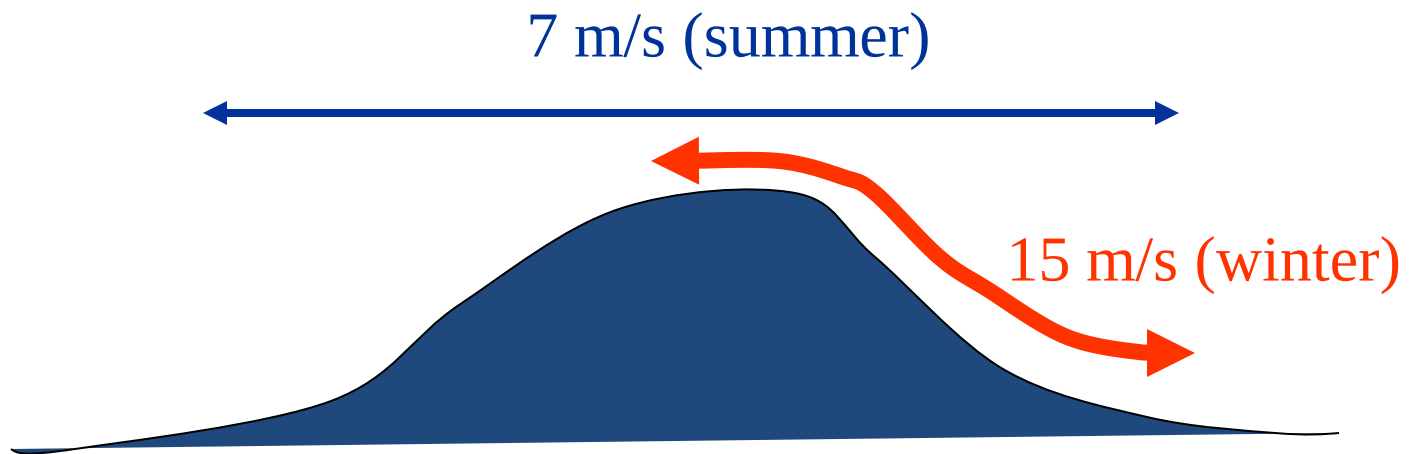
1950 1960 1970 1980 1990 2000

Seasonal cycle of wind power at 2 locations



SEASON





Main conclusions

- In the complex terrain of Iceland there is great variability of wind power in time and space associated with variability in wind directions
- Changes in local wind power in a future climate may predominantly stem from changes in wind directions, rather than magnitude of the large scale winds
- High-resolution simulations are needed to map winds in current climate and to scale down simulations of future climate